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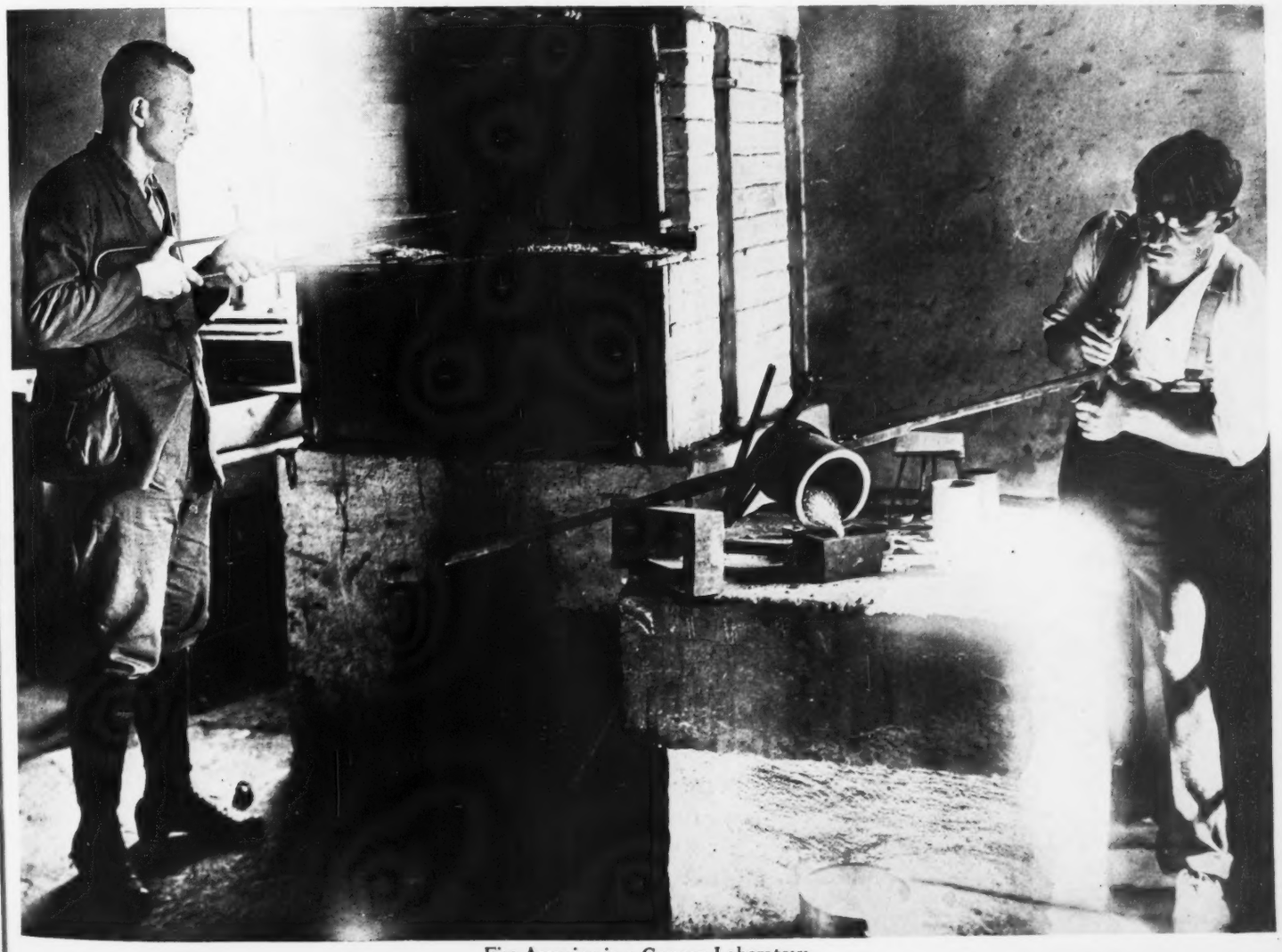

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ENGINEERING AND
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JOSIAH EDWARD SPURR, Editor

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The Lady or the Tiger

ONE OF THE RECOGNIZED RULES of the engineer, as of the rest of mankind, is loyalty. But there may arise cases in his career when he is confronted with the problem: loyalty to whom?

An engineer who recently expressed himself on the question of ethics, remarked that the problem looked easy to him. Much of it, he thought, could be summed up in two precepts:

"Don't double-cross your employer."

"Don't double-cross your fellow engineer."

This sounds grand. What does it mean? The exact operation of double-crossing has never presented itself as a clear picture to our vision; consequently we are not sure whether or not we have been in the habit of double-crossing. But assuming that the engineer in question has the same nebulous conception of double-crossing that we have—hard to define—let us consider the case of another engineer who wrote to us recently. He is assistant to the general manager of a mine. He is glad of the job, and is doing his best. The general manager, in his opinion, is neglecting his work—he partakes too much of home brew—sits up too late over the ten-cent ante, makes decisions when not in condition, antagonizes his men, makes the labor problem more difficult. When the directors come to the mine, he is perfect in the art of showing them around and making a solid impression. The assistant manager is holding things together to the best of his ability: nevertheless, the property is suffering from the general manager's weakening. Our junior engineer is lying awake nights trying to decide whether or not to report his conviction as to the incapacity of his chief to the directors. If he does not, is he loyal to his employer; or is he double-crossing him? He is taking his employer's money: does he not owe his employer his best service and loyalty?

Suppose, however (he reflects), he should do this. Is not this underhanded toward his superior officer and professional brother? Would he not fail in loyalty; would he not be double-crossing him? Would not his chief and his brother engineers consider him a seeker after favor, a boot-licker, a poor sport?

The upshot, he writes, will probably be that, worn out with the debate, he will throw up the job and move on without having confided his troubles to anyone but us; being unable to give his chief's policy support and tacit sanction, and unable to bring himself to try to cut the ground out from under him. And if he does quit thus he has a heavy foreboding—having, perhaps, the legendary New England conscience—that he will be doing the weak and wrong thing. He is doing good service where he is: will his departure help the company or his chief? And, lastly, he probably cannot readily get as much salary elsewhere. He doubts if this would be loyalty to his family—the shifting of home, the changing of school for the children, uncertain income. He feels that possibly a third of these smug maxims might be:

"Don't double-cross your wife and children."

So that, whatever he does, or if he does nothing, when you meet this engineer and notice the slightly furtive and hang-dog cast to his otherwise robust and engaging personality, you will know that it comes from a subconsciousness of not having done the right thing: as the New Yorkers (being a commercial and hence arithmetical race) say, he feels he has not been 100 per cent ethical.

The Limelight on a Certain Mining Promotion

AS EARLY as July, 1923, or earlier, a campaign was launched by John Hogan, Incorporated, of New York, to sell stock in the Idaho Gold Mining Corporation, organized for reopening certain old mines at Rocky Bar, Idaho. Some of the newspaper publicity and circulars came repeatedly to the attention of the State Mine Inspector of Idaho, Mr. Stewart Campbell, who noted that the state had no record of the existence of this corporation, or of the officers, or of any of the facts required by the state laws. In pursuance of his official duty, he therefore, on June 25, 1923, addressed himself to the de facto local manager of the company, Mr. George Short, of Salt Lake City, requesting that the corporation comply with the Idaho laws. Accordingly, on July 2, Mr. Short referred the inspector to "our local attorney, Mr. Thomas J. Maginnis, of Ogden, Utah." No word was forthcoming from Mr. Maginnis, but on Sept. 24 Mr. Julius Levy, a lawyer of New York, made himself known to the Mine Inspector and asked instructions as to how to comply with the laws of Idaho, but made no move to comply. On Oct. 25 and on Dec. 14 the State Inspector repeatedly supplied the company's representative with the proper forms for report, but without result.

On Dec. 18, Samuel Newhouse, a prominent mining man of Salt Lake City, appeared as president and manager of the Idaho Gold Corporation in a telegram sent to Julius Levy as the secretary of the corporation. Mr. Newhouse congratulated the stockholders that samples of a new strike on the Clifton vein of the company's property, reported by Mr. Short, averaged $581 for 10 inches; and that this had been checked by Mr. Harry S. Joseph, who got $472 for a width of 18 inches. Mr. Newhouse added concerning the mine: "I feel that it is surely destined to be a great producer." Just when Mr. Newhouse became president does not appear, but apparently not long before that date; on Dec. 28, he wired the Mine Inspector that he was a "recently newly elected officer" of the company. This telegram of Mr. Newhouse was made the basis for a bulletin to the stockholders on Dec. 20—a "Christmas Greeting," submitted without comment by Max Forst,

vice-president, from the New York office at 5 Beekman St.

At this stage Mr. George Graham Rice appeared on the scene as the deus ex machina: better said, he popped up dramatically as the real Company, behind these various agents. He wired Mr. Sidney Norman in Spokane to engage a reliable independent engineer to report on the reported strike. Norman (without revealing the identity of his client) asked Stewart Campbell to recommend an engineer, and Mr. Campbell recommended Mr. Gordon C. Smith, and accompanied him to the mine, returning to Boise, Idaho, Dec. 21. Smith reported to Norman that the "strike" ran not over $36 for a one-foot width, instead of $572 over 18 inches, as reported by Joseph. Campbell filed a report to the Governor of Idaho in which he makes the same statement; also reporting that "the vein is a small, irregular, spotted and badly faulted quartz vein."

Thereupon Mr. Campbell issued a public warning, calling attention to the exaggerated reports. He gave it to The Associated Press, which refused to publish it. He also telegraphed it to the *Mining Journal-Press*, which published it. Here is where we enter the story, as the faithful and fearless reporter. Mr. Campbell wired that "the vein does not have the appearance of developing a commercial tonnage, and the entire showing does not warrant the publicity given to it"; that "this company has never complied with the mining or 'blue-sky' laws of Idaho, and as its advertising circulars and press articles are misleading, I consider that the public as well as the press should be so advised." The *Idaho Statesman* (Boise) also gave wide publicity to Campbell's warning on Dec. 27 and 28. The limelight of publicity caused commotion. Mr. Jess Hawley, of Boise, who it seems had been appointed on Oct. 16 as statutory agent (a nominal connection only) for the Idaho Gold Corporation, resigned at once, presumably aware for the first time of the character of the enterprize that he represented.

George Graham Rice, who now appeared as controlling the stock of the corporation, wired Mr. Newhouse, demanding his resignation, on the ground that he had issued misleading reports. On Jan. 3, 1924, Mr. Newhouse resigned; and Mr. Rice was "elected" president. (Three million out of five million shares of the company are controlled by Kathryn Rice.) Early in March, Mr. Rice wrote us giving the foregoing information. Mr. Rice emerges virtuous and with clean hands: indeed, he is a clever strategist, far more perspicacious than the men who served as his employees or agents. He proceeded to comply with the Idaho law, filing a report on Feb. 2.

This is the whole story, told once before in our editorial of March 29. We have received several letters and telegrams calling attention to alleged inaccuracies and asking that corrections be published; accordingly we restate the whole matter in the light of up-to-date information.

Referring to personal letters from actors in the little play: we must profess the highest admiration for the public-spirited activity of the State Mine Inspector and his chief, Governor Moore. Mr. Gordon C. Smith has maintained what we understand has always been a most honorable record as an engineer. He did not know, incidentally, who his real client was. He was recommended for the examination by Mr. Campbell, who, of course, was also unaware that the report was to be made for the Idaho Gold Corporation, and still in the dark as to who controlled the corporation.

Mr. Short doubtless knew he was working for Mr. Rice. He resigned on Jan. 4 from his appointment as consulting engineer. He admits that his "alliance with the Idaho Gold Corporation was most unfortunate for myself, and a bit of poor judgment on my part." He disclaims any dishonorable conduct, and some of his friends have taken the trouble to write to us vouching for him emphatically. Mr. Short, we hope, has had a lesson.

The case of Mr. Samuel Newhouse is pathetic. He acknowledges in a letter to the Mine Inspector on April 7 that he resigned on the demand of Rice, but contends that "the company did not wish to accept my resignation"—ignorant, apparently, of the fact that the company is absolutely controlled by Rice. Nevertheless, he avers, he remained firm in his determination to resign, especially after ascertaining all of the details of the criminal record of Rice, "no part of which I was familiar with when I assumed the presidency of the company." Comment would be superfluous.

As regards Mr. Sidney Norman, the news that the engineer that he engaged was recommended by Mr. Campbell applies to him as well as to all other parties concerned. The fact still remains that he was unwise to act as Mr. Rice's agent, purely from the fact that Rice has been in the past perhaps the most notorious mine promoter crook in America. (There have been plenty just as bad, but not so noted.) Of Norman, Rice writes to Campbell that "the Idaho Gold Corporation, through me, was directly responsible for the examination of the ore showings in the mine and the checking of the Newhouse report by the engineer who accompanied you. It engaged that engineer to make the trip with you (and in order not to prejudice him in the company's favor *instructed its agent* not to disclose to him who his principal was) and paid his full bill." (The italics are ours.) Mr. Gordon C. Smith writes "The fact that *Mr. Norman's client* turned out to be Mr. Rice is interesting, but has no bearing upon my report." Mr. Campbell writes: "Mr. Sidney Norman called me by long distance telephone and stated he had a *client in New York*, whose identity he could not divulge, who desired a telegraphic report on the mine being operated by this company."

Mr. Norman himself has wired us objecting to our editorial, but confirming the association above stated. His curious argument is that he got nothing from Rice for the job. If he had, the situation would not have been changed for the worse. Why did he act as confidential agent for Rice on telegraphic request? When were these close relations established? Was it a matter of business courtesy? We doubt it. Was it out of personal regard? We cannot think so, for this reason: In a prospectus prepared by Sidney Norman and signed by him on Nov. 1, 1921, appears this statement: "After running successfully for several years, it (*Mining Age*) was purchased by the notorious George Graham Rice and turned into a house organ for the advancement of his equally notorious promotions." Mr. Norman has indulged in much verbal swashbuckling about the matter, but as yet is the only participant in the game that has not laid his cards on the table. Not that we are further interested. Our journalistic duty led us into chronicling this petty affair, as above explained; and we are glad to get out of it.

Conservation of Petroleum

UNDER THE PRESIDENT'S POLICY of conservation in aid of national security, a commission of three, known as the Commission on Oil Reserves, was recently appointed by Mr. Coolidge. One of the members of this body, and its chairman, is Dr. George Otis Smith, Director of the U. S. Geological Survey. The others are Admiral Hilary P. Jones, until recently Commander in Chief of the Atlantic Fleet, and Reed D. Bush, state oil and gas supervisor for California.

Dr. Smith's appointment comes as recognition of the part the Survey has played in connection with the federal policy of safeguarding a reserve of fuel oil for the Navy. Sixteen years ago it first pointed out the superiority of liquid fuel for warships and suggested that the government retain ownership of certain oil lands in California. As a result, the lands in what later became Naval Reserves Nos. 1 and 2 and part of those in No. 3 were withdrawn from entry in 1909, and in 1915 the reserves themselves were created.

The President has done a wise thing in appointing this commission. At a time when politicians have taken advantage of the improper act of an ex-Secretary of the Interior to put in the worst possible light everything connected with the leasing of the naval reserves, it is well to ascertain the facts, not only as to the specific matters covered in the charges but as to the degree of the need of conserving petroleum for the requirements of the future.

Recently an engineer familiar with the facts as to Teapot Dome put them concisely before our readers, painting a much more favorable picture than had hitherto been given. It is now more generally appreciated that the Sinclair company got a lemon from the government rather than a plum. Similarly with the lease to the Doheny interests in Naval Reserve No. 1 in California, the Pan-American company claims that the obligations imposed on it are greatly in excess of any rights it gets. No lease like it has ever been accepted by an oil company, it says. The purpose of the lease was to protect the reserve against drainage by sudden drilling by active neighbors. The only rights to drill that the company says it has are in less than half of the total reserve, and so far, it is stated, its obligations to drill offset wells have monopolized its time and activities.

A little more light on these matters, coming as a result of the unbiased study of the high-minded members of the commission, will help the public see the situation as it really is.

Foreign Taxation and the Mining Industries

TAXATION is of such personal moment that one is inclined to pay scant attention to the troubles of the other fellow. However, an increasing realization of the interdependence of national prosperity has stimulated interest in the assessments levied by foreign governments on their industries and individuals. In this connection it is interesting to note that the direct government revenue from the mines of the Witwatersrand increased from £1,440,223 in 1914 to about £2,850,000 in 1923. The amazing vigor of the world's principal gold field, and its ability to bear this additional burden, is reflected in recent statistics issued by the Gold Producers' Committee. During this interval the total working expenditures at the mines increased from £21,943,692 to £26,553,094. Yield rose from 8,033,570 oz. to 8,898,731 oz.; and in spite of the appreciation in working cost per ton, from 17s. 1d. to 20s., dividends in 1923 were £8,411,970, compared with £8,073,436 in 1914. In view of the continued deepening of the mines and the increasing complexity of some of the ore in the Far East Rand, these results are significant of the intensive application of economy and research in the handling of resources which, although vast in extent, are being exhausted rapidly.

The metal miner of the United States, however, is more vitally interested in another phase of foreign taxation: How are post-war assessments of this character affecting the buying power of Europe? It must be recognized that, whatever the weight of Great Britain in the metal markets of the United States, she exerts a stabilizing influence on Europe as a whole. It is therefore a matter of moment and concern to us to realize that British industries are being crushed to threatened extinction under a load of taxation that imperils world progress. Central government taxes in Great Britain show an increase of 350 per cent since 1913. The total paid per head of population now amounts to £15 18s. per annum, which is equivalent to about $10 per head more than the combined taxes levied by their governments on the peoples of Germany, France, and Italy, each of which is a heavy debtor of Great Britain's.

In discussing this subject with a distinguished British mining engineer, we were somewhat surprised to find that he, and doubtless many others who are equally well informed, viewed the existing plan of British indebtedness repayment to the United States as one incapable of continued fulfillment. In course of time, he maintained, the task would become a physical impossibility. This aspect of the matter is worth considering. Great Britain has shown a willingness to meet obligations in a manner unrecognized by any other European nation; but it will be as well to anticipate the effect on Europe if British industry falls under the staggering load of taxation now being imposed to meet obligations and to provide doles for men out of employment because of industrial depression.

The Bonus System Applied to Technical Men

DISCUSSION of labor conditions, wages, bonus payments, and welfare work of various kinds is conspicuous at times. Corporations and companies, either voluntarily or through being compelled to by labor organizations, concentrate their attention upon this labor subject, and as a result no little progress toward improvement in both wages and working conditions can be noted. The latest is in the development of the bonus system. This is based upon the determination of a working standard for different kinds of underground work. A workman attaining the standard will receive day's pay. He also obtains day's pay even if he fails to reach the standard. For performance in excess of the standard, the money saving to the company is split 50-50 and the workman is paid his share. This is an equitable arrangement and is advantageous to both workman and company.

The operation of this system of compensation will, in our opinion, relieve many labor difficulties. How-

ever, the system should not stop with the worker, but should be applied generally to everyone in the employ of the company. Technical men are relatively small in number as compared to workmen, but the control of operations and improvement in operating costs and increased recoveries are dependent upon the diligence and technical knowledge of these men. Nothing is said about a bonus for them. The average technical man in the employ of a mining company is dependent upon his salary. This is determined, not by his ability or the services rendered, but by the prevailing custom or by the ideas of the man in charge. The technical man invests in a four-year university course and in several experience years. This is brought to his employer at what the employer is pleased to term the ruling wage. To get out of the vortex of the "ruling wage," he has few alternatives. One is to establish an office and undertake consulting work. The other is to capitalize his experience in other fields or to become a mine owner and operator. In the last-named capacity he must be able to attract capital, for usually he has little capital of his own. The consolidation of mining interests and keen competition have restricted the opportunities afforded by consulting practice. No little capital is required to bridge the gap between company employment and an established professional clientele.

One of the strong sinews of the industry is the technical man. It is a direct loss to the industry when he leaves it for other activities. As a consequence there is need for substantial recognition within the industry. We espouse his cause and suggest to companies that substantial bonuses be paid where technical men in their employ have made important saving in operating costs or increased recoveries in ore treatment that result in additional income. We feel that it is just as important for a company to contribute its share in maintaining a strong, hopeful aggregate of technical men in the industry as it is to maintain a satisfactory working force.

Ponzi, Beggs, and Eliot

MEET Bert Eliot, Mr. Harmon Beggs. He is swiping your stuff. Or is Mr. Eliot the fellow whom Mr. Beggs sees whenever he glances in the looking glass? We wonder.

Recently we introduced Mr. Beggs to our readers as the sure thing, 2,000 per cent get-rick-quick promoter who has been sending his literature broadcast from Mexico City, P. O. Box 32 *bis*. Now comes another flock of lurid leaflets very like those sent out by Mr. Beggs, if not identical, except that they come from Mr. Eliot, Box 2578, Mexico City. Both gentlemen announced their plan, based on recognition, peace, and hope of profits, on Dec. 1 last, and both predict that it cannot last beyond six months. There is a strong suspicion that both Messrs. Beggs and Eliot are one and the same person.

There is also a strong suspicion that the swindlers who conducted their campaigns from Dallas and other southwestern points, until recently when Dr. Cook and S. E. J. Cox were sent to federal prisons, have simply moved across the border. From the other side of the Rio Grande they can still send out their floods of evil literature. The American Government was so slow in acting against them that it was very much like locking the stable after the horse was gone. Millions were stolen, never to be refunded. Will the Mexican Government be as slow?

Vagaries of Prospecting and Exploration

STRANGE THINGS come out of the air: meteorites, volcanic and other dusts. A few observers have recorded fish and frogs. However, the supply from this source is limited, both with respect to amount and variety. We naturally expect rain, snow, and hail at times, and are therefore surprised at other gifts from the skies. From the earth, on the other hand, an unusual variety is afforded. Prospectors are constantly cruising around in the hope of finding mines and commercial minerals. Their efforts do not always go unrewarded, as is evidenced by gleaning local newspapers which record the unusual things.

For example, a well yielding carbonic acid gas has been brought in in Utah. A rich pocket, stated to have yielded approximately 40 lb. of gold, was taken out of the John Leland mine, near Jamestown, Calif., by two miners, who made the strike in an old tunnel ten feet from the entrance. Two other miners are said to have recovered over 40 lb. of gold from a pocket discovered in the Fox mine, near Sonora, Calif. The discovery was made in driving a raise from an abandoned tunnel.

Recently a report emanated from San Bernardino, Calif., to the effect that, in drilling an oil well, gold nuggets the size of peas were taken out at a depth of 600 ft. Gold nuggets were reported to have been found in an ancient Indian cave in the Manzana district of the Santa Barbara forest. A short time ago two miners appeared in Tonopah with two large sacks containing ore so rich in gold that the local millmen refused to treat it, and the lucky prospectors were compelled to take off their jackets and pound the ore in hand mortars and wash it in pans. Prehistoric bones of an ancient race were reported to have been unearthed in the vicinity of Los Angeles.

These are a few of the unusual happenings that have appeared recently. Although probably none hold out the hope of new mines, they do, however, indicate that many individuals are searching around and that the prospector is discovering a sufficient variety to keep up his interest.

On the other hand, mining companies are doing in the aggregate a large amount of exploration, all of which has a direct bearing upon the maintenance of metal and mineral production. As a recent example, the Tonopah Mining Co. is said to have acquired the old mining claims at Treasure Hill, near Hamilton, Nev. This property was worked many years ago, but has since been only sporadically worked by leasers. Engineers believe that it is worthy of systematic exploration. Another company has started exploration of a mineral area at Blind Springs Hill, near Benton, Calif. These properties were worked by leasing, but the various holdings have been consolidated in the expectation of securing sufficient capital for exploration. At Virginia City, a development company has explored the middle group of mines and has purchased the properties with a view to their operation. These activities are substantial and in contrast with small-scale prospecting. It is from such operations that the producer of staying power is brought out.

Making White Arsenic at Toulon, Nev.

New Independent Company Mines and Roasts 15 per cent Arsenical Ores

By George J. Young
Associate Editor

RECENT HIGH PRICES of white arsenic, owing to its demand for weed killers and insecticides, have caused many mining men to consider the possibility of establishing independent plants for the recovery of that product from arsenical ores. Hitherto practically all of the arsenic has been produced as a byproduct by Anaconda, the American Smelting & Refining, and the U. S. Smelting companies, the centers of production having been Tacoma, Anaconda, Denver, and Midvale. In general, ore producers have been penalized by the smelting companies where arsenic was associated with other metals in their ores, but this is not now the practice where the arsenic is recovered. The present situation has opened up a new source of profit and has widened the mining field.

E. H. Wedekind, who gained experience in producing arsenic in France for the French Government, recognized the commercial possibilities in exploiting arsenical deposits when he returned to the United States. About four years ago he started to acquire mining properties and to plan metallurgical equipment for the treatment of arsenical ores. He gained control of the Byllsby tungsten concentrator, at Toulon, Nev., and several arsenical prospects near Battle Mountain. A company was organized and two Wedge furnaces were purchased at Ludwig, Nev., and installed at the concentrator. Condensers were built and the plant was brought near to completion. In June, 1922, W. K. Reese, Jr., purchased the plant and joined with H. C. Haas in organizing the Toulon Arsenic Co., which took

The Irish Rose

over the reduction plant and the mines, and subsequently completed and enlarged the plant.

The present plant is at Toulon, on the main line (Ogden to San Francisco) of the Southern Pacific railroad, 14 miles west of Lovelock, Nev., the postoffice address of the company. Toulon is 130 miles from Battle Mountain; and the Irish Rose mine, now being operated by the company, is 9 miles by road from Battle Mountain and near Galena. The Irish Rose is on a vein in quartzite. The oreshoot is opened by an adit and has been drifted 800 ft. It is estimated to have backs totaling 350 ft. The vein is from 2 to 10 ft. wide, and dips 65 deg., and present ore reserves are computed at 50,000 tons. In addition the company has acquired the Gem mine, 22 miles south of Beowawe, Nev. An inclined shaft 450 ft. deep was on the property, which was an old prospect. Subsequent developments have exposed 30,000 tons of ore.

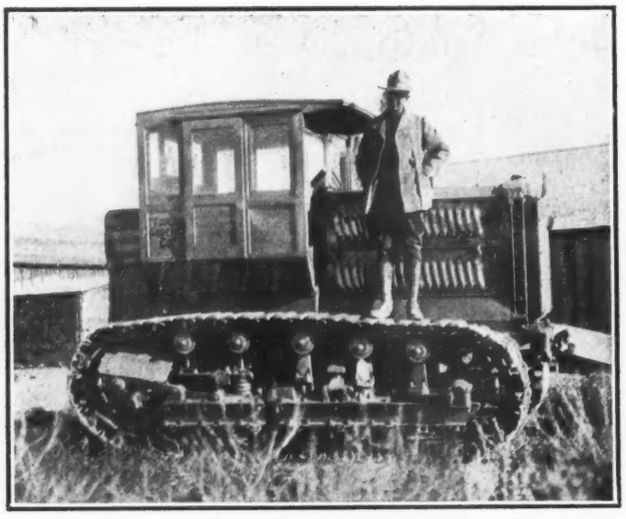
The Irish Rose is the only property now being operated, a shaft having been started to prove the vein at

General view of the country surrounding the Irish Rose mine

greater depth. Mining operations are relatively simple. The ore is mined by shrinkage stoping and trammed through the adit to a loading bin. There it is loaded into tractor-drawn trains and transported to Battle Mountain, where it is transferred to railroad cars and delivered to Toulon. Two 10-ton artillery-type, Holt caterpillar tractors and ten 6-ton Troy wagons are used for this service, with motor trucks as auxiliaries. When the road is muddy, 30 tons is hauled in a train; ordinarily, 40 tons. The caterpillar tractors have proved their ability to overcome road conditions that cannot be undertaken with the motor trucks. A maximum speed of five miles an hour can be made with the caterpillars.

The treatment of the arsenic ore is relatively simple. Two classes are made, selected or picked ore containing 15 to 20 per cent arsenic and 17 to 20 per cent sulphur, and lower-grade ore, which is to be concentrated. The concentrator equipment consists of a Herman mill equipped with a 16-mesh discharge screen, eight Deister-Overstrom tables (three roughers and five slimers), hydraulic classifier, and Callow cones. The concentrates are partly dewatered by a Dorr classifier and are dried by passing through a worm conveyor, the outer shell of which is heated by an oil flame. The ore is crushed to ½ in. before going to the Herman mill. Picked furnace ore is crushed and sized to a maximum of $\frac{7}{16}$ in. by a revolving trommel before going to the furnace.

Roasting is accomplished in two six-hearth Wedge furnaces. The upper three hearths of each furnace are provided with separate flues and dampers so as to con-



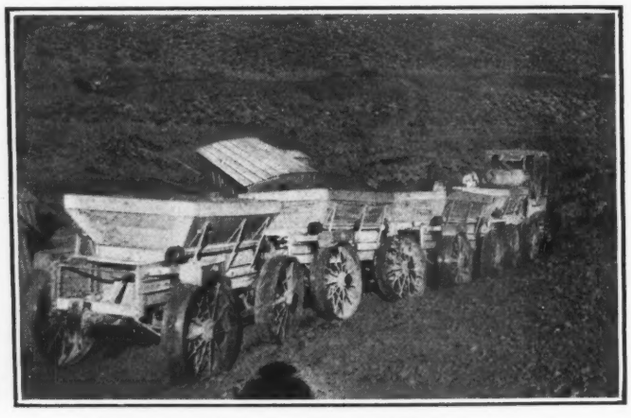
Tractor used for hauling ore cars

trol the roasting positively. Roasting is at a relatively low temperature, 1,400 deg. F., and little or no extraneous fuel is used. The gases pass to cylindrical brick dust chambers, and are then conducted to four balloon flues or condensers in series, the residual gases being discharged by a stack. The arsenic trioxide is deposited in the flues. Fuller details of the calcining practice are withheld by the company. The method of handling was invented by E. H. Wedekind, now deceased.

White Arsenic Is 95 to 96 per Cent Pure

The furnace ore consists of pyrite, arsenopyrite, accompanying sulphides, and gangue. Its analysis approximates 18 per cent sulphur, 15 per cent arsenic, 20 per cent iron, and 18 per cent "insoluble." Both lead and zinc occur in small amounts, as well as gold, silver, and copper. The calcine carries about 2 per cent arsenic, and is shipped to custom smelters. The recovery of arsenic is 85 per cent, the arsenic trioxide being in the amorphous or finely divided form. A small amount of iron and "insoluble" is retained in the crude arsenic trioxide, which is from 95 to 96 per cent pure. It is packed in barrels, marketed to chemical manufacturers in carload lots, and used for the manufacture of weed killers and insecticides, as well as in plate-glass manufacture.

The capacity of the plant is 50 tons of ore per furnace per day. The output of arsenic ranges from 125 to 250 tons per month, depending upon the grade of the ore. Arrangements are being completed to treat oxidized arsenical ores, which will be mixed with sulphide ores and furnaced. Twenty-five men are employed at the mine and the same number at the plant. W. K. Reese, Jr., president of the company, is general manager; W. D. Green is superintendent at Toulon, and F. H. Partington is in charge of the mining operations. Marketing is handled by H. C. Haas from the San Francisco office of the company.



Transporting ore from Irish Rose mine to Battle Mountain

No Fume or Water Problem at Toulon

The selection of Toulon was originally based on the availability of a tungsten concentrator at that point. As water was available in only small quantity at the mine, and an agricultural community surrounds Battle Mountain, the Toulon plant was retained, as it afforded abundant water and freedom from interference with farming interests. It is also a convenient railroad point for the company's custom business with near-by mines.

Custom ores, containing at least 15 per cent arsenic, are also purchased by the company. Those containing antimony, mercury, or cadmium are not bought, as these elements contaminate the product. A flat price is paid for the arsenic content. Smelter settlements are made on the gold, silver, and lead content, and zinc is penalized where it exceeds the smelter limit in the resulting calcine. Oxidized arsenic ores are purchased only on analysis and in limited amount.

The reduction plant at Toulon

Cuba's Iron Resources

The iron ores of Cuba are said to constitute one of the largest reserves of the world, but as no geological survey has ever been made of the island, this statement cannot be verified, says *Commerce Reports*. The most extensive deposits occur in Oriente Province. There are two kinds of deposits: (1) The hematite and magnetite ores, averaging 58 per cent iron, with 9,000,000 tons of ore near the city of Santiago on the south coast, and (2) the brown iron ores, averaging 45 per cent iron, with 3,000,000,000 tons on the north coast. The chief mines of both types are in Oriente Province. There are also other smaller iron ore deposits in the island.

The total available reserve of ore, containing more than 40 per cent iron, has been estimated as follows: Oriente Province, 2,660 million tons; Camaguey Province, 400 million tons; Habana Province, 50 million tons; Pinar del Rio Province, 40 million tons.

At present the only important copper mine, and practically the only one of any kind being worked, is the adjoining copper and silver mines at Matahambre in the Province of Pinar del Rio.

The First Use of Metals

III—Iron, Lead, and Zinc

By T. A. Rickard

SOONER OR LATER the smelting of copper ores would lead to the discovery that another metal could be obtained from red stones. On the Sinai Peninsula rich iron ore outcrops near the veins of copper ore; heaps of ancient iron slags in that district, of a date later than the earliest copper mining, indicate that the later Egyptians obtained iron, as well as copper, from this Red Sea region. It is easy to imagine how primitive man might mistake a red iron ore for a red copper ore, such as is common in an oxidized lode. Indeed one's imagination need not be unduly stretched to suppose that the cremation of a corpse in Neolithic time, when the dead were covered with red paint, that is, iron ochre, might lead to the accidental production of a small bit of iron. If this happened the fact was not recorded; but the reduction of iron is so easy that it remains surprising that Neolithic man failed to discover it sooner.

The temperature needed to reduce an iron ore is only 700 deg. C., as compared with the 1,083 deg. required for the reduction of a copper ore. Nor is any artificial blast necessary. Again we must infer the ways of primitive man from those of a child, for his mental faculties were yet undeveloped. He would be attracted by what was pretty; so he picked up gold first, then native copper; and after he had melted the copper, he would sooner or later be led naturally to the smelting of the ore in which the native metal was incased. On the other hand, native iron was not known to him, so a similar chain of causation was not created. But once he ascertained that the red or brown stone (hematite or limonite) would yield a new metal, malleable like copper, and therefore shapable by hammering, he would have no difficulty in producing it, for the extraction of malleable iron from its ore is one of the simplest of metallurgical operations. This simplicity, or ease of performance, is due to the fact that the smelting of an iron ore does not involve the complete fusion of the metal, which is obtained in the form of a spongy mass, or "bloom" (from the Anglo-Saxon *blooma*, a lump), which can be forged easily into a bar.

Early Reduction of Iron Ores

The fact that iron becomes soft and agglomerates (at 700 deg. C.) before undergoing complete fusion (at 1,530 deg.) was of the greatest importance to the primitive metallurgist, because he could collect the malleable pieces or lumps that he reduced from his ores and then could weld them together under percussion, by hammering or forging. How this was done is indicated by methods still in vogue among primitive races. The Akikuyu, in British East Africa, obtain their iron ore in the form of a magnetite sand, which they mine and concentrate from a deposit that they have been working for many generations. Their hearth is a hole, 28x23 in., lined with clay. This they fill with alternate layers of ore and charcoal, which is blown into active combustion by the blast from a bellows, a cone of sewn goatskin, at the apex of which is a carved wooden pipe, 6 in. long, that fits into an earthenware nozzle 3 ft. long. This tuyère, as it would be called in modern technology, rests on the lip of the hearth, its nose being directed downward so that the point is buried under the charcoal lying on top of the ore.

When the smelt is finished, the charcoal on top and on the sides is removed, the remaining contents of the hearth are sprinkled with water, so as to cool the semi-globular mass, which is then pulled, by means of a rope made of banana leaf, over the lip of the hearth, and then rolled clear of it. More water is sprinkled on this hot coherent mass, after which it is broken with water-worn stones (or boulders) into pieces, among which the wrought iron is found to have run together in small lumps, or "blooms," weighing about two pounds apiece. These lumps are heated, and then hammered on an anvil. For a long time soft iron was used; then it was discovered that it could be hardened by heating and sudden quenching. The delay in the making of this discovery may have been due to the fact that copper, with which primitive man was first acquainted, is hardened by hammering, but softened by heating and quenching in water.

Iron Found in Pyramid of Knufu

Iron was known long before it came into general use. The oldest piece as yet discovered was the one found between two of the inner blocks of stone in an air shaft of the great pyramid of Knufu, constructed in about 2800 B.C. Another fragment of iron was found at Abydos among copper tools of the sixth dynasty, or about 2500 B.C. Nevertheless, iron did not begin to come into general use until the seventeenth century B.C., at the time of the Egyptian invasion of Asia. References to objects of iron are found in the inscriptions of that period. By the time of Ramses II (1292-1225 B.C.) the use of iron was common in Egypt.

The Use of Meteoric Iron

The fact that some tools should have been made of iron so early as 2800 B.C. and yet that the metal should not have come into common use in Egypt until nearly fifteen centuries is a discrepancy that has puzzled the archæologists.

The oldest religious texts, of 3500 B.C., speak of the firmament being formed of a rectangular piece of iron. The Egyptian word for iron was *baa-en-pet*, or "metal of heaven." Likewise in the primitive picture-writing of Babylonia iron was denoted by two characters representing "heaven" and "stone." According to Homer, one of the prizes awarded at the games in honor of the funeral of Patroclus was a "self-fused" mass of iron, large enough "to suffice its possessor for all purposes during five years." It is interesting to compare the Greek word for iron, *sidēros*, with the Greek word for a star, *astēr*, and the Latin, *sidus*, *sideris*. These etymological suggestions were scouted for a long time, but their implication is now no longer doubtful. Travelers to Greenland, more than a hundred years ago, had made known the fact that the Eskimos were using pieces of iron torn from several large meteorites, or siderites, lying on the shore of Melville Bay. One of these "stones

from heaven" was softer than the others, and therefore had been used most. About half of the original mass had been detached by the Eskimos; what remained was estimated by Peary to weigh 6,000 lb. The iron contains 8 per cent of nickel; it is soft but tough, and had been detached bit by bit in the same way as the Indians worried pieces of metal from the masses of native copper in the Lake Superior region. The scraps of iron thus obtained by the Eskimos were hammered cold between stones. The Aztecs when first known to Europeans had a little iron, which they prized above gold, and which they said had come from the sky. Averrhoes, an Arab philosopher of the twelfth century, states that excellent swords were made from a meteor, weighing 100 lb., that fell near Cordova, in Spain. These facts were on record, but their significance was not properly appreciated until G. F. Zimmer, in a paper before the Iron and Steel Institute, in 1916, gave fresh emphasis to them by enumerating forty-three other instances of meteoric iron being wrought into tools and implements. The localities specified are scattered all over the world. In Africa the products of this celestial metal include dishes, lance heads, rifle bullets, and hoes. The meteoric iron must be worked differently from artificial iron, and that is why the idea had prevailed that it was not applicable to industrial purposes. Archæologists had insisted that it was not malleable, but in this they were mistaken. The iron of meteors averages 92 per cent pure, and it is identifiable by its nickel content, which usually averages 7 per cent, and by the crystalline structure that produces what are known as the Widmannstätten figures. It is strange that these criteria were not used sooner in ascertaining whether the iron of the Great Pyramid and other ancient pieces of metal were of meteoric origin or had been smelted by man. I venture to suggest that the surface of Egypt—a sandy plain on both sides of the Nile valley—was admirably adapted to the reception of meteorites, because sand is resistant to penetration and yet resilient to impact.

The Use of Native Iron

The finding of the iron "from heaven" did not help man to obtain the metal from terrestrial ores, because there was no connection between them; nor was any native iron found by him close to such ores, in which respect the metallurgical history of iron differs from that of gold, silver, and copper, as we have seen. It is true, iron has been found native, for example, at Ovifak, in Greenland, where it occurs in a basalt that has erupted through beds containing coal, which may have caused the reduction of the iron. The natives have used it for making knives and other implements, as they have used the siderites, without any suggestion, so far as is known, from any sophisticated foreigner. The piece of iron found in the Great Pyramid has been analyzed recently, and is known now to be native metal; but, in face of the modern world-wide search for iron ores, it can be said that native iron is so rare in nature as to afford no basis for an assumption that it played any part in primitive human industry. Meteoric iron, on the other hand, is so widely distributed as to warrant the belief that it was used by man long before he had learned to smelt the metal from ores. The savage in his search for stones suitable for his purpose would be attracted by the unusual weight of a meteorite; he would discover that the substance of it could be shaped by hammering, not chipping. Moreover, he could detach small pieces, because most meteorites fall in fragments, and their surface is rugged or protuberant, so that bits are readily detachable even by aid of a stone implement. The Descubridora meteorite shows a cleft in which the broken end of a copper chisel has been left by some Neolithic man, who, evidently, had tried to detach a large part of the mass.

Thus many antiquarian discrepancies are cleared. As the supply of meteoric iron would be too scant to establish a so-called iron age, the general use of the metal could not begin until the ancients had learned to smelt the metal systematically from terrestrial ores. In Egypt that was done apparently in about 1300 B.C. A century earlier iron swords were brought into Greece by the Achæans, who, according to Ridgeway, came from central Europe. In a storeroom of the ruined palace of Sargon II, the king of Assyria from 721 to 706 B.C., were found 800 tons of iron in various shapes. The Biblical description of Tubal Cain as "an instructor of every artificer in brass and iron" has no historical value; it is merely the introduction of a tradition into a narrative that was written in 900 B.C. The taboo on iron, a prohibition to be found among ancient peoples all over the world, is associated probably with its meteoric origin.

Meteoric iron, as Zimmer says, was about equal in value to gold at the dawn of civilization, and its average value per ounce is about that of gold today. It was used as currency in Britain two thousand years ago, as in Paraguay at a recent date. In all probability the bars of iron used as money among the Spartans in the time of Lycurgus (about 850 B.C.) were of intraterrestrial origin. The forging of the thunderbolts of Jove by the Cyclopes is a mythologic expression of an interesting metallurgic fact.

Genesis of Nomenclature

The relative antiquity of the metals is indicated by the names given to them by those who first used them. The first thing of its kind shares its name with the entire class to which the thing belongs. So, whereas "corn" means maize in the United States, it means oats in Scotland, and wheat in England. In early Egypt silver was named "white gold," thereby indicating the priority of gold. A similar nomenclature survives in China and Burma to this day. Long after the Greeks had given the name of *cassiteros* to tin, the Romans called it *plumbum album*, or "white lead," which indicates that in the ancient world lead was known before tin. In Mexico *tepuztli* meant copper, or, more precisely, a copper hatchet, that being the first implement made out of the metal. Later iron was designated "black" *tepuztli*.

Substances sometimes obtained their names from the use to which they were first put; thus *sideros* was employed even in the time of Homer as a synonym for a sword, as likewise *ferrum* later was used by the Romans. Lucretius, in his famous description of primitive life, asserts that iron was discovered later than *aes*, or copper, which was further distinguished as *aes cuprium*, or "from Cyprus." The Greeks used the word *chalkos* first for copper, and later for bronze, but it must be noted also that they employed *chalkeus* for smith long after iron had supplanted copper as the chief industrial metal. To do the work of an ironsmith was *chalkein*. Thus *chalkos* was applied to metal in general.

Homer speaks of the iron (*sideros*) with which the Egyptians worked when building the Great Pyramid. He says the "among the Ethiopians bronze is the rarest

and most precious of all things," but they bound prisoners "in fetters of gold."

The references to the metals in Homer have been interpreted variously. Gladstone came to the conclusion that the word *chalkos*, as used by the earliest Greek writers, was applied to unalloyed copper, not to bronze. The epithets used by Homer—such as "red," "bright," and "shining"—are more fitting to the metal than to the alloy. The bending of the spearpoints of the warriors against the shields of their adversaries favors the supposition that their weapons were made of copper, not bronze. However, the mention of *cassiteros*, tin, with copper suggests the making of bronze; likewise the use of *chalkos* in the making of swords, because weapons of pure copper would be ineffective, and certainly no copper sword would break into pieces at a blow as described by Homer. For example, the blade of Lycon "up to the hilt was shivered." Evidently the copper contained some impurity, not tin, but perhaps antimony or bismuth, that made it extremely brittle.

In Homer's time—about 1000 B.C.—the use of iron was commencing. In the days of Hesiod, three centuries later, iron was cheaper than bronze, which had become associated with the traditions of the heroic age. Hesiod speaks of a time when men wrought in bronze and "dark iron" was unknown. Aeschylus (525-456 B.C.) alludes to iron as "the stranger from overseas," "the newcomer from the Scythians," and "the Chalybian stranger"—all of which points to the eastern shore of the Black Sea as the source from which the Greeks obtained their iron.

Not far from the Scythian plains at the foot of the Caucasus lived the Chalybes, the iron-making people of the ancient world, from whom is derived our word "chalybeate," a synonym for iron-bearing. Aeschylus, it will be noted, treats iron as an intruder; bronze was still the favorite to a poet nurtured in the romance of an earlier epoch. Thus a touch of sanctity clung to the older metal. As the use of stone was continued in the performance of sacrificial rites long after the metals had come into general use, so bronze was retained in priestly functions after iron had become common. The priest of Jupiter in ancient Rome had to shave his beard only with a bronze knife; and the site of a new town was delimited with a bronze plowshare.

Lead Known as Early as 2500 B.C.

Lead must have been known at a remote period, for it occurs commonly in association with silver, and therefore would be reduced in the smelting of silver ores. Owing to the low temperature at which it fuses, lead is easily extracted from its minerals, more particularly the carbonate (cerussite), which would be found in the surficial parts of silver-lead deposits. The discovery of lumps of lead in the deepest ruins of Hissarlik (the ancient Troy) proves that the metal was known in 2500 B.C. The source of this lead is not diffcult to conjecture, because deposits of argentiferous galena are to be found today in the hills northeast of Mount Ida and in the range of which Mount Olympus is a prominent peak on the frontiers of Mysia and Bithyrica. Mining operations have been conducted on the sites of ancient workings in these districts during recent years. Native lead is rare, but it has been found, for example, at Las Vegas, in southern Utah, where the Mormons used it for casting bullets.

Zinc has never been found in nature in a metallic state. It was not known in the remote past, so the mention of "brass" in translations of classic literature, such as the Old Testament, is an error. The earliest relics of this metal are bracelets that were found in the ruins of Cameros, which was destroyed in the sixth century B.C. After that the knowledge of zinc seems to have been lost, for although a little brass was made at that time, its composition appears not to have been ascertained. Two centuries later Aristotle speaks of this alloy as Moesinoecian copper, which, he states, is made by melting copper with a peculiar earth found on the shore of the Black Sea. This ore was named *cadmia*, from which we get our word "calamine," a name given to the carbonate of zinc in Europe and to the silicate in the United States—an anomaly for which there is no excuse.

In the time of Augustus calamine was used as an adulterant of bronze. A coin of 20 B.C. contains 17.31 per cent of zinc. The Romans ascertained, as the Greeks had done, that the smelting of copper with calamine yielded a yellow alloy more golden in color than bronze. The earlier brass, such as is mentioned in the Bible from the time of Job onward, was not a definite alloy, even if it contained zinc, which is unlikely, because the smelting of zinc ore is one of the most difficult operations in ordinary metallurgy. Brass was confused both with bronze and copper in the writings of antiquity and in the translating of them. Indeed, the knowledge of the metals, and of their chemical identities, was so vague among the ancients that it should not surprise us that they confused one with another, just as they inadvertently mixed them in the course of their elementary smelting operations.

No Orderly Sequence of So-called "Ages"

We have seen how the supposed sequence of cultural development, from a stone age through one of bronze to another of iron, did not characterize the civilization of Egypt, because probably a supply of tin was not available until a late period, when external trade brought it into the country. We have seen how native copper, and gold also, was used as soft stone long before either of them was melted into shape. This applies not to Egypt alone, but to the other early civilizations, as well as to the aborigines in regions not reached by the influence of ancient culture. The North American did not pass through a bronze age; he was using copper as stone when the European showed him the use of iron. Columbus records his astonishment, in his log book under date of Oct. 13, 1492, to find the inhabitants of Guanahani lacking in iron. The natives of Mexico, at the time of the Spanish conquest, in 1520, in like manner were unacquainted with the use of iron, although they had ornaments and implements of gold, and weapons of copper, which later they learned how to harden by alloying it with tin, as is proved by the analyses of Humboldt. In short, the assumption that a regular sequence of so-called ages, from stone to bronze and from bronze to iron, marked the cultural advancement of mankind everywhere is untenable. It may have been true in Greece, as the classic poets suggest, and it may have held good in Denmark, where the doctrine of "ages" found its modern recognition, but it was an exception, rather than a rule, and for the obvious reason that tin is a scarce metal, not to be found at all in most countries and scanty in many others.

Much of the supposed bronze of the archæologists is simply copper rendered impure, and hard, by ingre-

dients other than tin. The use of bronze was merely a phase in the use of copper; indeed, even the introduction of iron was a minor event compared with the first use of any metal by melting it into the shape needed for tools. The history of mankind is divisible into two grand epochs, a stone age and an age of metals, of which the second has lasted as yet only a fraction as long as the first. Between the two ages came a transitional period, which we may term chalcolithic, during which copper (and gold also) was used as stone. This lasted for a millennium, at least, and longer in some regions; and then came the casting of the copper, which lasted for another millennium, or longer, before bronze came into use. In some regions, the general use of copper continued until iron was introduced, so that a separate period of bronze culture is not recognizable; it overlapped either copper on one side or iron on the other. The critical event, one of the greatest in human history, was the first melting of a metal—the beginning of the metallurgic art.

The discovery that metal could be melted out of the rock, in whatever way it happened, was a momentous step in man's conquest of nature and marked the beginning of that complex state of living we term civilization. The prehistoric savage who saw the little lump of molten copper in the ashes of his camp fire could not guess what it portended; he could have no idea of the tremendous train of industrial progress that it would start; but we, who can look back down the vista of the ages, stand astonished at the consequences.

At first the use of metals in the making of better tools enabled man to clear the forest more rapidly, to grow bigger crops, and to build better dwellings. But that was only a small beginning: the red beads of copper that were sweated out of the stone on the hearth of the prehistoric savage were destined to be stretched into whispering wires across the earth; along them was to be brought the energy of the mountain torrent, to move the wheels of industry, to illumine the ways of man, and to light his dwelling.

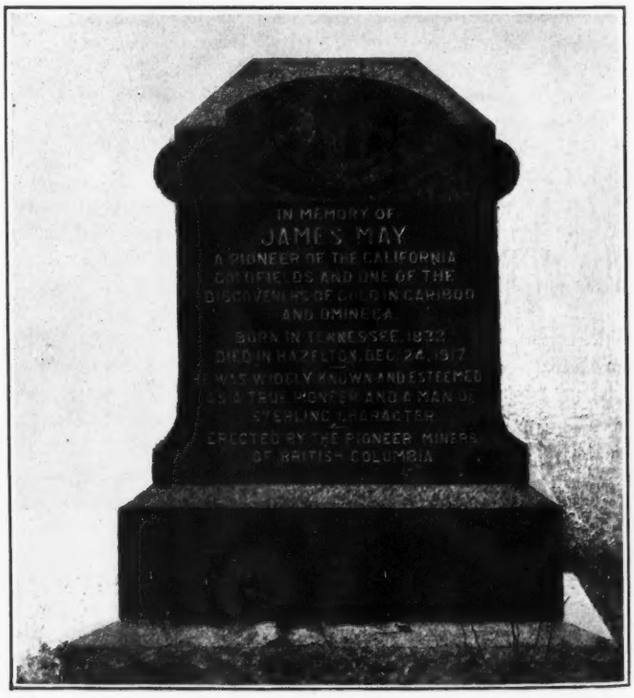
The use of copper led to the use of other metals, and thereby gave the means for making instruments of precision for the scientific discovery of the secrets of the universe. With the smoke of that lonely camp fire in Neolithic time there rose the vision of civilizations unborn, of achievements unbelievable, of devices to assist human muscle, of bridges thrown over gulfs of space, of steel roads that thunder with the traffic of the continents, of many-storied towers that top the tallest trees, of ships that mock the vagrant wind and dive beneath the restless wave, of machines that fly above the mountain crests and thread the clouds of heaven. In short, out of metals man made tools and by aid of tools he lifted himself out of savagery into civilization.

A Canadian Tribute to James May

BRITISH COLUMBIA miners have erected a monument to James May, the discoverer of the Caribou and Omineca gold fields. Born in Tennessee in 1832, May, when a youth, left for California. When word came down in the 50's that there was gold to the north, he was among the first who "rushed" to the then newly discovered diggings on the Fraser River at Yale, about 60 miles from what is now the city of Vancouver. Remaining there for a few months, he could not resist an urge to explore the unknown interior of British Columbia. He struck off into the wild Chilcotin Indian country, and within a short time, by his discovery of Antler Creek east of present-day Barkerville, he opened up the richest placer gold area ever found in that province. This was the historic Caribou country.

After the Caribou came the Omineca excitement, with its roaring camp at Manson Creek, and May was "in" with the first of them. When this camp played out, there seemed no more worlds to conquer, so he came down and settled at the old frontier town of Hazelton, where, universally respected and admired, he died at the age of eighty-five.

Perhaps even more than for their mineral discoveries the early Californian miners have a claim to fame by reason of their political influence upon British Columbia. In the 50's the whole territory, particularly the lower coastal region, was dominated by the Hudson's Bay Company through its able though autocratic representative, Sir James Douglas. His was an iron rule, with a single objective—the company's interests—and the sudden influx of thousands of spirited pioneers was calamitous to a rigid policy of isolation. Naturally, friction arose, and Sir James, keen fighter and all as he was, soon realized that a population which demanded representation and could back its demand must be treated with respect. Recognizing the inevitable, Sir James, as became him, was the first to suggest Imperial as against the company's administration, and to him was largely due the subsequent formation of a Crown Colony, with its government according to established usage. May and those like him builded better than they knew!



Monument erected to James May, one of the discoverers of gold in Caribou and Omineca

Extension of the Porcupine Gold Belt Into Quebec

A District Which Seems to Warrant Intensive Prospecting

By Douglas G. H. Wright and Walter E. Segsworth

IN THE REPORT of Cyril W. Knight on the Lightning River Gold Area[1] it was pointed out that the most important gold mines in the Province of Ontario were along two almost parallel belts, having an approximately east and west strike, and from 25 to 40 miles apart. The northerly of these two belts contains the Porcupine mines, the Croesus mine, in Munro Township, and the Lightning River prospects. The southerly belt traverses the Matachewan, Kirkland Lake, and Larder Lake areas. The characteristic features of these belts are the infolded sediments of Temiskaming age, which outcrop along their length, and the close proximity of the gold mines to these sediments.

Scant Literature Available on the Subject

The eastern extension of the southern or Kirkland Lake belt in the Province of Quebec has already received considerable mention in the technical press; and the promising finds in the Lake Fortune and Rouyn areas have centered attention on these new prospective gold fields. Little, if anything, however, has been written regarding the Quebec extension of the northern or Porcupine gold belt. During the last two summers the writers have explored part of the eastern continuation of this belt in Quebec, and they believe that a short account of the geology observed will be of interest to those following the development of gold mining in the North.

The accompanying map shows in a general way the geology of the area described. No accurate surveys were made, all data being secured by pace and compass work, and since the control (township) lines are 10 miles apart, it is hoped that the approximate location of the various features will be overlooked, and that the map will prove of service as a guide to field work.

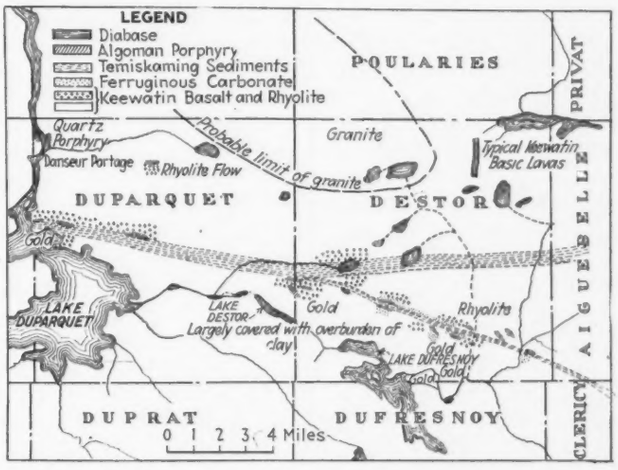
In the Destor-Duparquet area most of the rocks belong to the Keewatin series, and consist of lava flows, basic for the most part, but with frequent occurrences of pink and green rhyolites. The flows have been tilted up into almost vertical position and strike approximately east and west. These rocks in the northern halves of the two townships are comparatively unaltered and appear massive and fresh, though a microscopic examination reveals the fact that they have been subjected to intense changes, largely by metasomatic replacement processes.

Two Belts of Sedimentary Rocks

Striking roughly east and west across the southern third of the township is a belt of sedimentary rocks, conglomerate, graywacke, and slate, together with minor quartzite and arkose. Owing to a heavy mantle of clay, the full extent of these sediments is not definitely known, but the belt appears to be from thirty to fifty chains wide. The bedding planes now stand at a high angle; the dip varying between 80 deg. south and 80 deg. north.

[1]Issued in stencil by the Ontario Department of Mines.

Just near the western boundary of Destor Township another belt of sediments has apparently made a junction with this east-west belt. This second belt strikes from 20 deg. to 30 deg. south of east, and it is probable from the strike observed that it joins the southeast-northwest striking sediments shown on Geological Survey Map No. 145A[2] in the vicinity of Clay Hill Portage, on the Kenojevis River in Clericy Township.



Sketch map of gold area in northern Quebec

If this is so a striking structural feature is disclosed, and the second sedimentary belt in Destor Township lies along a major deformation connecting the two regional deformations which appear to control the distribution of gold deposits in the Pre-Cambrian of Ontario and Quebec. These sediments we class as Temiskaming series.

Signs of Igneous Activity Common

Intrusive into the rocks already mentioned are numerous dikes and stocks of feldspar porphyry, both red and gray, and some minor quartz porphyry. These intrusions are largely confined to and in the immediate vicinity of the infolded remnants of the Temiskaming series.

Outcrops of granite occur in the northwestern part of Destor Township. These outcrops we did not map, and their boundaries are not known. They probably connect with the granite on the east and north shores of Lake Abitibi, which is classed by the Ontario Geological Survey as Algoman, and we tentatively place this granite in the Algoman series.

Finally, intrusions of diabase dikes, in every way similar and in all probability the co-relatives of the Matachewan series of Ontario,[3] cut the preceding rocks. These dikes usually have a northerly strike, and since

[2]Accompanying M. E. Wilson's Memoir 103, Temiskaming County, Quebec.

[3]Dr. W. G. Miller: "The Matachewan Series and Its Pre-Cambrian Relations." *Canadian Mining Journal*, April 4, 1923.

they are later than the Algoman metallogenetic epoch[4] they have no bearing on the occurrence of the gold deposits.

The geology as briefly stated in the preceding paragraphs may be summarized in the following manner, the older rocks being shown at the bottom of the table:

Matachewan series	Diabase dikes, occasionally porphyritic.
Algoman series	Feldspar porphyry, quartz porphyry, granite (?), and syenite.
Temiskaming series	Conglomerate, graywacke, slates, minor quartzite, and arkose.
Keewatin series	Basalt, andesite, dacite, rhyolite, all displaying typical lava flow structure, namely pillow lava, amygdaloidal, volcanic fragmentals.

The maps of the Dominion Geological Survey[5] show an occurrence of Cobalt series sediments in Destor Township. This we did not see, but an occurrence of Temiskaming sediments was observed in approximately the same position as that mapped as Cobalt series.

In proximity to these two belts of sediments the rocks are locally greatly sheared, and occurrences of schistose rocks belonging to the Keewatin and Temiskaming series are common. The rocks, too, have been locally impregnated with carbonate until they are now altered to ferruginous carbonates. This alteration, it will be remembered, is quite common in Porcupine, Matachewan, and the Larder Lake camps. Speaking specifically of the Larder Lake Camp, H. C. Cooke[6] with reference to similar alteration termed by this writer "dolomitization," says, "It may be assumed, therefore, that the carbonate solutions were the final exhalations from this deep-seated Algoman magma."

In Ontario two factors seem absolutely essential for ore deposition: one, dynamic disturbances, the other, igneous activity, and to date the economic gold deposits of Ontario all belong to that epoch following granite intrusions of Algoman age. Intrusive action will usually be most pronounced along zones of structural weakness. The presence of infolded Temiskaming sediments at once marks the area containing them as one having undergone great dynamic disturbances, during which the once almost horizontal sediments have been deeply infolded with the basement of Keewatin volcanics.

In addition to the presence of the Temiskaming sediments the first factor is indicated by the shearing along the length of the belt and ample evidence of the second vital factor exists in the abundant intrusion of porphyries of Algoman age, and the presence of ferruginous carbonate rocks.

From the foregoing, it will be realized that the Duparquet-Destor area possesses the two essentials for the localization of metalliferous deposits.

Porphyry Rocks Good Signs

We wish to point out that the Duparquet Destor area, possessing as it does a main structural direction of weakness along belts of disturbed rocks, including infolded Temiskaming sediments, and associated with intrusive action, corresponding to the Algoman of Ontario, is an area which merits careful, painstaking prospecting. In this connection the following extract from Mr. Knight's report[4] is of interest: "Therefore, to the prospector we would say: explore for feldspar porphyry and quartz porphyry in or near these great belts of sediments."

[4]Dr. W. G. Miller and Cyril W. Knight: "Metallogenetic Epochs in the Pre-Cambrian of Ontario."
[5]See reference [2].
[6]H. C. Cooke: Geological Survey of Canada. Memoir 131. p. 55.

Though only the townships of Duparquet and Destor have received specific mention in this paper and the accompanying map, prospecting to the east, into Aiguebelle, Manneville, and Villemontel townships, might reasonably be expected to disclose the presence of this synclinal belt joining up with that mapped by M. E. Wilson in Figuery Township; and prospecting southeast through Clericy, northeast Joanne, and northwest Bousquet townships might confirm the theories herein expressed relative to the existence of a transverse synclinal trough, between the two east-west regional synclines, commonly called the two gold belts.

Considerable staking has already been done, but there is still much open ground. Practically no work has been performed except a little trenching to comply with the requirements of the mining law of Quebec. The area is virtually unprospected, and consequently to date no deposit of gold, of proven economic value, has been located. Occurrences of free gold are widespread, and an odd spectacular find has been made. One gold nugget weighing three and a half ounces is said to have been found by Joe Lepine on a claim staked by him in the southeast quarter of Destor Township. Gold was seen in place on this claim by one of the writers of this article. The occurrence was in a rusty stringer cutting a metabasalt into which pinkish-colored feldspar porphyry had been freely injected.

Gold has been found just northeast of Dufresnoy Lake and on the north shore of Duparquet Lake. On Beatty's Island, in Duparquet Lake, gold may be panned from a stockwork of quartz stringers, in basalt. On a claim near the Duparquet-Destor boundary, channel samples across fifteen feet gave assays of $3 per ton gold, and one sample of five feet gave $7 per ton gold.

Thorough Prospecting Attractive

The widespread occurrence of gold, under such favorable geological conditions, justifies the intensive prospecting of this field, and encourages the hope that exploration would be rewarded by the development of an area of economic importance somewhere along this Quebec extension of Ontario's northern gold belt. It will be seen that this belt parallels in a general way the north shore of Duparquet, Destor, and Dufresnoy lakes, and in summer these lakes and their tributary waters furnish the easiest mode of access. From La Sarre station, on the Canadian National Ry., a motor launch can go by the La Sarre River, Lake Abitibi, and the Abitibi River to Danseur Portage, 22 miles. At this point a track leads over a short portage; and from there a motor launch will reach any part of Lake Duparquet. From Danseur Portage to the east end of Duparquet Lake is 11 miles. From the east end of the lake a canoe route follows up the creek, and from the head of the creek two easy portages lead into Lake Destor and on into Dufresnoy Lake. In winter a good road runs south from Makamik, 25 miles, into the heart of the belt in Destor Township.

We wish to acknowledge the work of the first prospectors in the field, to whose efforts its recognition is largely due. John Beatty has prospected and developed claims in Duparquet Township since 1910. The Brookbank brothers, of Swastika, were early prospectors in Destor, followed by P. Boissonault, J. Lepine, J. Cleary, J. H. Robb, and others, to all of whom we are indebted for information, guiding, and hospitality.

Gold Mining in Germany

Old Properties in Bavaria Reopened by Fichtelgold Company

By S. P. Grosse

GOLD mining or finding gold in Germany has become a mere curiosity since the discoveries of immense gold deposits in California, Alaska, South Africa, and Australia. Even at times as far back as 1679 it was the same, when Prince Theodor of the Rhineland (Pfalz) could coin from all the gold washed from the sands of the river Rhine only 60 ducats (one ducat in size, weight, and value is about equal to an American $20 gold piece), which coins were buried, together with the cornerstone of the Concordia Church, at Mannheim, or when King Ludwig I of Bavaria had coined also from the Rhine sands a few gold thalers as a curiosity, with the inscription in Latin *"Sic fulgurant litora Rheni"* ("thus glitter the banks of the Rhine").

Ancient Methods Still Persist

In comparison with the considerable silver production from the mines in the Harz Mountains and in Saxony, near Freiberg and near the Bohemian Riesengebirge, gold mining in Germany did not amount to much. The gold washers on the Rhine could hardly make a living; 50 per cent of the gold was lost in the tailings. The methods of washing were too primitive, and although the principles are the same today, the machines have been improved. Today, as during the eighteenth century, the gold is collected on amalgamating plates, although, as every mining man knows, the treatment of low-grade gold and silver ores made an immense progress with the use of cyanide plants first built on the Rand in South Africa.

Old Mines May Be Reworked

The Germans have now taken into consideration modern improvements, made first by mining engineers in South Africa, and have taken up the working of old gold mines at Brandenholz, in the Fichtel Gebirge near the famous town of Bayreuth, in Bavaria. Brandenholz is the center of many little villages in the Fichtel Gebirge, which have names like Goldberg and Goldkronach, indicating their relation to the former gold mining in that district. In 1546, the Markgraf of Brandenburg, who was owner of the land around Bayreuth, according to Agricola received weekly about 1,500 gold gulden (one gold gulden equal to about two American dollars), or a total production of 3.75 kilos of gold per week. As only about 50 per cent of the gold content of the ores could be extracted, the treatment of the tailings should be profitable today. With this expectation in view, a mining company was formed under the name of "Fichtelgold" about a year or so ago.

Though the low-grade but uniform gold ores near Johannesburg, in South Africa, assay about 9 grams to the ton, the Fichtelgold ores assay uniformly 7 grams. The gold-bearing mother lode runs from north to south for a length of 9,000 ft. and is mostly of quartz, which came up from beneath, penetrating the slate, which is the base formation of the Fichtel Gebirge. This mother lode, which by recent prospect work has been found to extend to 3½ kilometers, or about six miles, was mined in different places from time to time during the last three or four centuries. However, after the Thirty Years' War operations ceased. At the end of the eighteenth century the Prussian Government appointed A. von Humbold as general manager or director of all the mines in the Fichtel Gebirge. The French invasion, however, stopped all work. Since then, except for a few trials, no work has been done at all.

Present Operations to Be Actively Prosecuted

The company that has taken over the mines has begun work in earnest, and with the best modern machinery as well as with mining engineers with experience in foreign lands. The present general manager has been for years in South Africa; the superintendent of the mill has also had experience in South Africa and elsewhere, and the mine foreman is likewise an experienced miner from the Rand. Instead of first building an elaborate office and manager's residence as formerly was the custom, the new company sank a new shaft 600 ft. deep and cut the vein on the incline in quartz 150 ft. below the deepest point of the old workings, thus leaving 150 ft. of gold-bearing ores, 2 to 8 ft. in width, above and a not yet determined quantity of ores in the depth below. The newly driven crosscuts, right and left, have attained a total length of about 1,600 ft., and 8,000 tons of ore was hoisted up to last July.

The ores are crushed wet in two five-stamp mills. A third five-stamp mill is under construction. The crushed ore runs down an inclined sluice, where copper amalgamating plates are arranged like steps. The slimes are conducted into huge cyanide tanks for treatment. Cheap electric power is used throughout.

Metallurgical Results Satisfactory

The first report of production from recent operations was published on Oct. 16, 1923, giving the amount of gold caught on the plates during about sixty working days as a little over 6 kilos. The amount of gold taken in solution has not yet been determined. The results are considered satisfactory, as very poor ores were crushed for a trial run.

About sixty-five men are now employed in the mines, and each unit of five stamps in the mill is attended by only one man. The cost of production and overhead costs cannot be accurately stated, because the value of the mark is different every week. However, the results so far have been such that the company was able to declare a 100 per cent dividend in July last.

Silesian Mines Also Reopened

In addition to the mines in the Fichtel Gebirge, the company owns mines in Silesia, near Hussdorf, which have been reopened. Antimony and arsenic are the principal ores. Furthermore, the company bought a large complex—in fact 2,650 hectares (one hectare comprising 30,000 sq.ft.)—of old silver mines in Saxony near Annaberg, the famous old mining district not far from Freiberg. The present silver price stimulated the reopening of most of the old silver mines in Saxony, where the Freiberg mines are working full blast. Old Freiberg students may be interested in the fact that more than three hundred tunnels had been driven since mining began in the Annaberg and Buchholz mining district.

The various minerals found in these mines were silver, copper, cobalt, bismuth, lead, iron, zinc, antimony, arsenic, and sulphur, and also in considerable quantity tungsten and uranium, which carried traces of radium.

Chronicles of the Sierra

A Trip to Quiruvilca—Don Guess and Politics—Good Symptoms or Bad?

Translated by Allen H. Rogers from *El Norte*, March 24, 1924, Trujillo, Peru

ON ONE of those sunny mornings which are succeeded on our uplands by stormy nights during these months, we traveled over the interminable uplands on the haciendas Chota and Llaray, anxious to reach our destination, the Mecca of all those who have a blind faith in the immense treasurer which during so many centuries have been guarded by the jealous peaks of our mountain ranges: Quiruvilca.

We passed huts and humble shepherds, until after crossing a river and traveling a further short distance we were surprised to see two cholitas (young Indian girls), elegantly dressed, with shawls over their shoulders, patent leather shoes, and white hats, the neatness of which had been somewhat spoiled by the recent rains. We traveled gaily among the tufted grasses of the uplands, and the figures of the girls formed a marked contrast to those that a few moments before we passed near the sheepfolds. These travelers were the first indication that we were close to Quiruvilca. In fact, just around the hill appeared the tunnel mouths and dumps of the innumerable mines which, together, are called Quiruvilca. Long encampments and fairly good-sized houses of more or less elegance produced on us the agreeable impression of being in the future Cerro de Pasco of our Department. As we approached, the activity and progress of this mining region became more evident. Machinery, electric power, tracks, cars, and laborers who moved them around in different directions, completed our first impression.

A Tribute to Yankee Pluck

It is evident that Quiruvilca marches with great strides toward the future, determined by that group of brave citizens who with admirable tenacity and self-denial endured, for more than fourteen years, the bad climate, privations, prejudices, and lack of understanding of their compatriots. The recompense which they today receive from the powerful Yankee company which has bought this region will be relatively small in comparison with all the energies and sleepless nights spent in sustaining the prestige of this important and rich copper-mining district.

That the gentlemen of the "Northern" company have taken Quiruvilca is a fact: Mr. Guess has said so, and even should St. John lower his finger, he could not counteract the determination of this "Mr.," for many of us a mysterious personage who makes his appearances like Halley's Comet, and, like it, produces all classes of phenomena and turnings-upside-down in this Department.

Capital—a question of 5,000,000 soles, more or less—a small matter, to us here, who are now accustomed to hear millions of soles, where before we heard loads of potatoes and wheat—a question of title.

"Personal" Politics

What effect will Mr. Guess have on our political situation? Seemingly none, incredible as it may seem. Nevertheless, he has exercised an undoubted influence in the political atmosphere of our uplands. We are in the year of general elections, the year when we, the sons of this region, commence to arm ourselves to the teeth and to strain our lungs shouting for our particular candidates, and, nevertheless, up until now the political thermometer from Quirihuac to Quiruvilca shows zero degrees of temperature. Nobody knows, and apparently nobody cares, who are the favored candidates. The subprefects, governors and holders of political office are in bad straits: the more fire they put under the political oven the less the temperature rises, and when they wish to hold a meeting of the style to which we are so accustomed from Lima to Lucma, the semi-hypnotized crowds, instead of shouting "Viva Candidate Blank!" shout "Viva don Mr. Guess!"

There is not one peasant to whom the idea has not occurred of offering to this gentleman one of the vacancies in the Senate. Such is the spirit of the times, and ample opportunity is given to philosophize on the decisive influence that the powerful American company is exercising in the immense zone of the uplands, where its activities have taken root. No one wants to know about politics, and politics interests nobody. Everybody asks, "What does Mr. Guess say?" "Will he buy Quiruvilca?" "Will there be a smelter?" "Will there be an aerial tramway?" "How far has the cart road reached already?" or, perhaps, "It is true that airplanes are going to come?"

Native Officials Not Active In People's Behalf

Everybody is reaping the benefit of the great satisfaction which well-paid work gives, and everybody desires to recognize not the Candidate X or Z, but the man who, by a kind of magic—if we may so qualify his action—is materially and morally transforming our uplands. Is this lack of patriotism? Perhaps, but the masses are not to blame. The blame belongs to the politicians, the senators, deputies and public functionaries in general, who never busied themselves in forming or protecting national industries or in securing work for everybody, offering them an honorable way of earning a living and not obliging them to make such living by means of depravity and trickery and at the expense of the dignity of man.

We boast of polished and patriotic citizens, but, nevertheless, we are dragged along by the enthusiasm of the masses of the people, and with them we say, "Viva don Mr. Guess!"

Tasmania's Mineral Production

Returns from the Tasmanian Mines Department showing the quantity and value of the mineral products for the State of Tasmania during the year ended Dec. 31, 1923, follow:

Mineral	Quantity	Value £
Gold, ounces	3,684.124	16,639
Osmiridium, ounces	673.423	(a) 19,642
Silver, ounces	636,805.61	91,339
Lead, tons	4,784.057	127,542
Copper, tons	6,064.7	435,413
Tin, tons	1,160.39	235,955
Coal, tons	80,718	70,797
Wolfram, tons	96.86	6,150
Shale, tons	1,101	1,094
Iron pyrites, tons	8,016	18,038
Carbide, tons	3,236	64,720
Limestone, tons	99,113	122,428
Total	.....	£1,209,757

(a) Value at market price at time of export, subject to correction.

The Electrolytic Zinc Co. recovered 41,153 tons of zinc, valued at £1,293,422, and 107.004 tons of cadmium, valued at £27,551.

Mapping Cross-sections of Orebodies

Drill-hole Data and Geologic Deductions Should Be Combined

By James E. Harding
Mining Engineer, Casilla B, Antofagasta, Chile

IN EFFECT, a cross-section of an orebody is "mapped imagination." One is accustomed to think of maps as representing definite objects or things, which can be approached, observed, and measured with a high degree of accuracy. In contradistinction to such a map, a cross-section has as a rule only one line upon it which can be so determined, that line being the profile. Everything below the profile line is imagination, or perhaps better stated as calculated imagination. To be sure, data obtained from a drill hole are usually rather definite, but even the conclusions obtained from those data are more a result of deductive reasoning than actual observation, since no one can visit and examine the spot from which any particular sample is obtained.

Structural Geology Important

For the purpose of making a cross-section of any orebody, a careful and painstaking study of the geology, both structurally and genetically, is highly important. By such study in many cases it is possible to determine closely the horizontal limits of ore, together with the strike and dip of such boundaries. Possibly, also, by study it may be found that the ore is limited to some particular rock, which by some characteristics may be differentiated from the inclosing formations. If the drill-hole sampling has been carefully followed by a petrographical study of each sample, an invaluable aid to delineating the subsurface geology has been secured.

Even though, in making up sections, every possible source of information has been exhausted, and the sections have been made with the highest degree of care and intelligence, unforeseen conditions will arise to cause the sections to be inaccurate. Nevertheless, when so made, a set of sections will check with the results of actual development work very closely.

The chief utility of a set of cross-sections is to facilitate the planning of mining methods, haulage systems, ore passes, and the general workings for the extraction of the ore. When once such a plan has been determined upon and the work of driving the necessary openings is well started, it is disastrous economically to find out that the plans and workings have been predicated on a false conception of the shape, size, and lay of the ore. For that reason it is important that the sections on which mining plans are predicated be as nearly true as it is possible to make them.

To be of any value at all the sections must show not only the location and shape of the bodies considered as ore, with the corresponding grade, but also the location of any waste bodies which may be prejudicial to the removal of the ore, together with the relative location of the ore and the inclosing formations. Therefore, summed up briefly, the section should show the grade of material at any given point upon it.

Assuming, then, that an orebody has been more or less thoroughly drilled and sampled, that the data have been compiled, and that the geology has been worked out, we have the essential material at hand for the making up of a set of cross-sections.

The first thing necessary is a well-made surface map showing topography, geology, and the location of drill holes. For an illustrative problem all these data have been placed on the map in Fig. 1, but that map is too complicated for easy working. For such purposes it would be better to carry one map for drill holes and topography and a separate map for surface geology, both to the same scale.

When the surface map has been made, the orientation

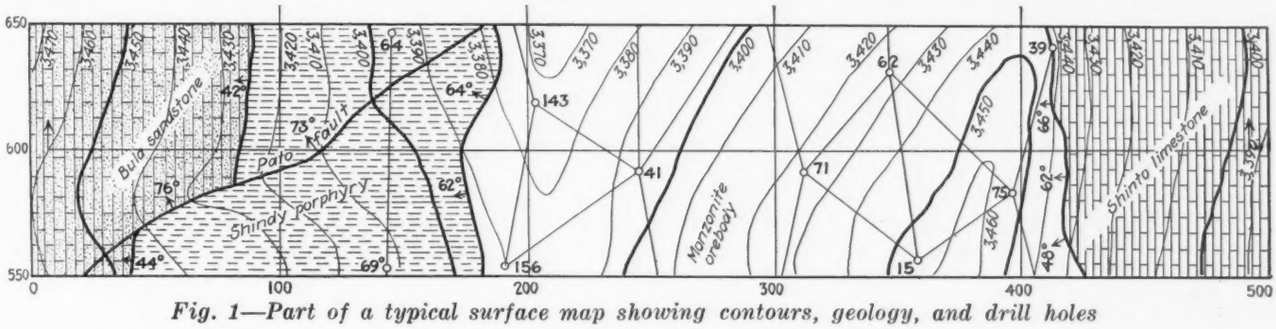


Fig. 1—Part of a typical surface map showing contours, geology, and drill holes

of the sections, together with their interval, may be decided. For the orientation of the sections, we should know the directions of the major and minor axes of the orebody; the sections should be at right angles to the major axis, no matter whether the bearings of the axes correspond to the points of the compass or not. In case the bearings of the axes do not correspond, a difficulty which will be later discussed will be encountered.

For preliminary work, the interval between sections does not need to be closer than 100 ft., and even might be stretched to 150 or 200 ft. on occasion. There is really little use in spacing cross-sections along the major axis, at right angles to it, much closer than the interval generally between drill holes. Therefore if the orebody has been drilled with close-spaced holes, the sections should be closer together, and if the drill holes are far apart the sections may be spaced far apart.

Map Co-ordinates Parallel Axis of Deposit

When the section interval has been decided upon, taking the major axis of the orebody as a base line, the surface map is divided by straight lines, into square blocks with a side equal to the section interval. For convenience, each one of these lines should be numbered

in series, starting from one corner, such as the southwest, and numbering in consequence to the east and to the north. Thus "north 900, east 300" means a definite point on the map.

Here we come to the difficulty mentioned in a previous paragraph. In all probability the mine will already have a set of co-ordinates, on which maps are made, established before the work of sectioning is done, and in case the major and minor axes of the orebody do not coincide with the points of the compass, the section co-ordinates mean nothing at all in terms of the original co-ordinates. To get around the difficulties engenpolations, considerable preliminary work is necessary. First the card shown in Fig. 2 is made up from the churn-drill log. This card, in addition to carrying the number of the hole, co-ordinates of location, and elevation of collar of hole, shows horizontally, in three divisions, total copper, soluble copper, and acid-consumption per ton. The latter two of these divisions are unnecessary for the interpolation, but are used later in calculating tonnages of copper, pounds of acid to be used and other information.

For the purpose of making these sections, the ore mass is separated into three grades, namely 0.0 to 0.5

LA FINCA EXPLORATION — Hole No. 122

Co-ords. N. 2132.28 E. 1331.46 El. Collar 3454.36 — Depth 1395 Ft.

	FEET, DEPTH		TOTAL COPPER									SOLUBLE COPPER									ACID CONS., LB. PER TON								
			0.0% – 0.5%			0.5% – 1.0%			1.0% and over			0.0% – 0.5%			0.5% – 1.0%			1.0% and over			0.0% – 0.5%			0.5% – 1.0%			1.0% and over		
	From	To	Ft.	%	Product	Ft.	%	Product	Ft.	%	Product	Ft.	%	Product	Ft.	%	Product	Ft.	%	Product	Ft.	lb.	Product	Ft.	lb.	Product	Ft.	lb.	Product
OXIDE ZONE	0	60							60	2.07	124.20							60	2.02	121.20							60	101	6060.0
	60	95				35	0.69	24.15							35	0.61	21.35							35	97	3395.0			
	95	126							30	1.14	34.20							30	1.06	31.80							30	92	2760.0
	126	165	40	0.39	15.60							40	0.32	12.80							40	76	3040.0						
	165	270				105	0.72	75.60							105	0.68	71.40							105	72	7560.0			
	270	285							15	1.37	20.85							15	1.28	19.20							15	84	1260.0
	285	315				30	0.74	22.20							30	0.70	21.00							30	65	1950.0			
	315	330							15	1.61	24.15							15	1.52	22.80							15	72	1080.0
	330	470				140	0.75	105.00							140	0.62	86.80							140	58	8120.0			
	470	485							15	1.55	23.25							15	1.48	22.20							15	52	780.0
	485	595				110	0.69	75.90							110	0.58	63.80							110	112	11620.0			
	595	640	115	0.31	13.95							115	0.26	11.76							45	52	2340.0						
	640	745				105	0.73	76.75							105	0.60	63.00							105	38	3990.0			
	Totals		85	0.35	29.55	525	0.72	379.60	135	1.68	226.65	85	0.29	24.56	525	0.62	327.38	135	1.61	217.20	86	63	5380.0	525	56	29435.0	135	88	11940.0
SULPHIDE ZONE	745	770				25	0.66	16.50							25	0.20	5.00							25	36	900.0			
	770	1120							350	1.62	567.00							350	0.10	35.01							350	26	9100.0
	1120	1150				30	0.87	26.10							30	0.08	2.40							30	32	960.0			
	1150	1270							120	2.05	246.00							120	0.06	7.20							120	27	3240.0
	1270	1380				110	0.67	73.70							110	0.05	5.50							110	31	3410.0			
	1380	1395	15	0.16	2.40							15	0.02	0.30							15	21	315.0						
	Totals		15	0.16	2.40	165	0.70	116.30	470	1.73	813.00	15	0.02	0.30	165	0.08	12.90	470	0.09	42.20	15	21	315.0	165	32	5270.0	470	26	12340.0

Fig. 2—Drill-hole data from which interpolation cards are prepared

dered by the two sets of co-ordinates, all workings are surveyed and stations are plotted in terms of the original co-ordinates, and all workings are named from the section co-ordinates. This is by no means an ideal condition, but so far I have been able to find no better way around the difficulty.

It is also to be noted on Fig. 1 that drill holes are connected to one another by lines. Having arbitrarily selected a section interval, it is obvious that in almost all cases the section will not pass directly through a drill hole, but will cut at some point the lines connecting the drill holes. Therefore we interpolate directly on the section the trace or line where the plane of the section cuts the plane bounded by the drill holes and spot the locations of grades of ore directly from the suggestions furnished by the assayed samples from the drill holes.

For the purpose of preparing and making such interper cent, 0.5 to 1.0 per cent, and 1.0 per cent and over, for the reason that everything above 1.0 per cent is considered minable. If more or different divisions are desirable, they may just as easily be made. The particular orebody for which this system was designed had no zone of mixed ore—that is, a zone of ore carrying copper in both sulphide and oxide form between the oxides and sulphides. If the system were applied to an orebody carrying such mixed ore there would have to be three vertical divisions on the card instead of two, as here shown.

From the data on Fig. 2 we make up Fig. 3. As any given hole may require as many as six cards such as Fig. 3, several hundred cards will be required, of a size about 6x10 in., cut from ordinary drawing paper. A single line is drawn across each card, such as 3,300 on Fig. 3.

For the purpose of making the interpolation between any two holes, the distance between the two holes is scaled from Fig. 1. Then two parallel lines are drawn vertically on the card distant from each other the scaled distance between the two holes. On one of these lines the elevation of the collar of one of the holes is first established in accordance with the original reference line; then downward on the line is plotted the location of the various grades and divisions of ore taken from the card, Fig. 2. The second hole is treated in the same way, giving in each case a condensed log, drawn to scale, showing the location of various grades of ore. The scale is the same as will be used later on the sections.

With the two holes thus drawn the interpolation can be made immediately. First draw the line connecting the collars representing the surface, then connect the two points at which sulphide ore is encountered. We have at surface in both holes a zone of over 1.0 per cent, and assuming that this ore is continuous between them, we draw it accordingly. Next we have in both cases a zone of 0.5 to 1.0 per cent which is demarked. Then a zone of over 1.0 per cent which is indicated. Just above the sulphide line in Hole 156 we have a zone of the Class 0.0 to 0.5 per cent and another of 0.5 to 1.0 per cent, with nothing corresponding to them in Hole 143. Therefore we bring both these zones to a point at top of sulphide in Hole 143.

In the case of the sulphide zone the interpolation is entirely obvious, and we have a plane between the two holes, on which are represented zones of ore of different grades. The trace of any intersecting plane, such as that of a cross-section, will show on this plane as a straight line, which is indicated as "Line of Section." Scaling on the surface map, Fig. 1, to determine at what point the section cuts between Hole 143 and Hole 156, we locate the point at the proper distance from either Hole 143 or Hole 156, and through that point draw a straight line parallel to the lines representing the holes. This line is the trace on which the section plane cuts the plane between the two holes.

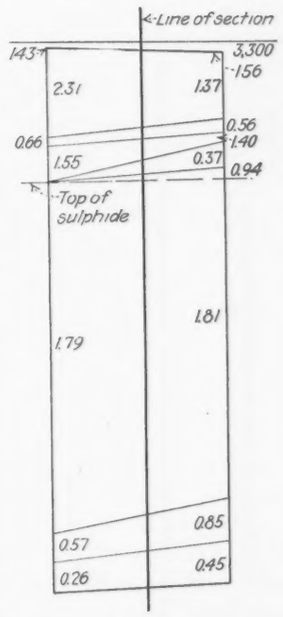


Fig. 3—Illustrative interpolation card

For the purpose of demonstrating this method of interpolation a simple example has been selected inten-

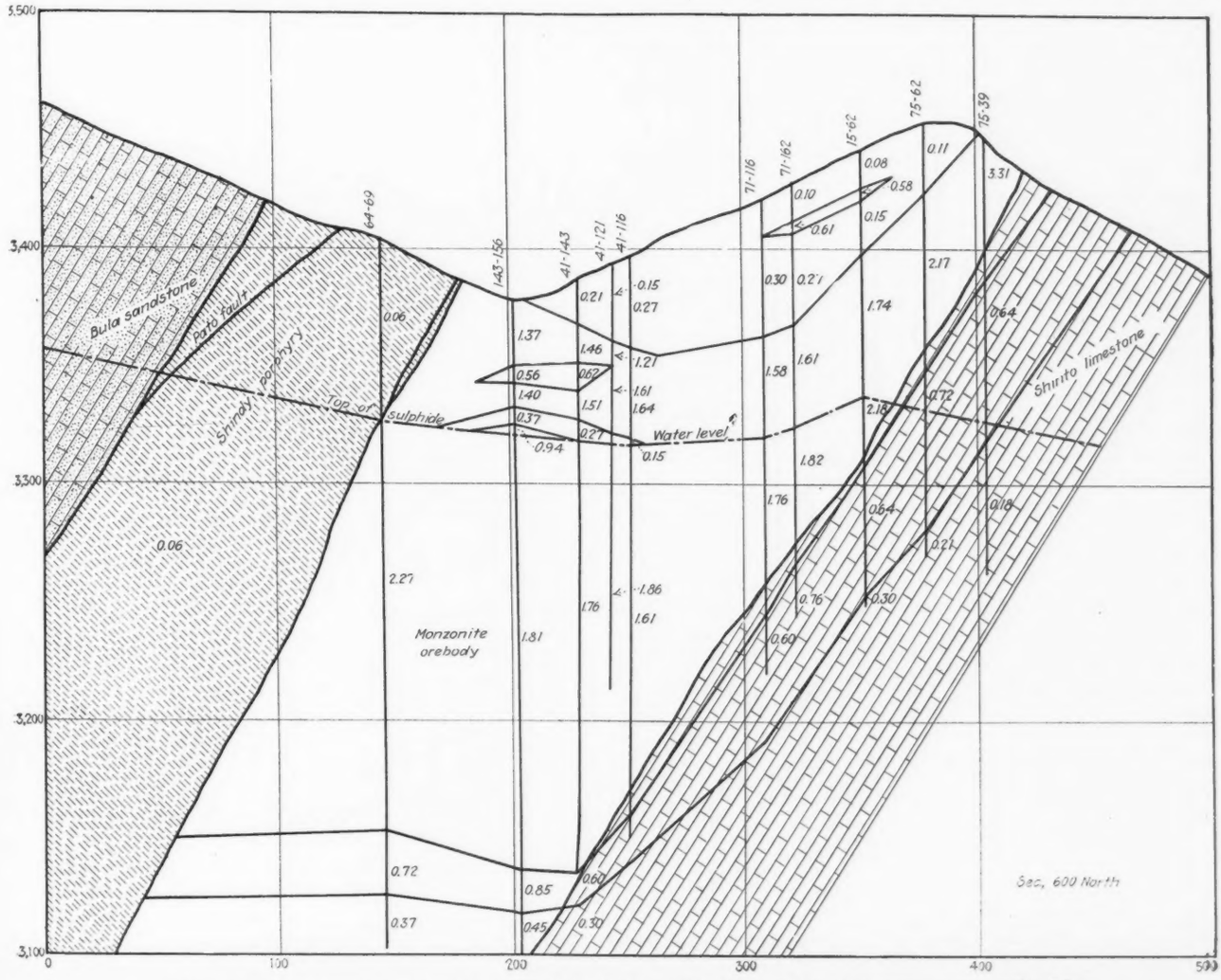


Fig. 4—Cross-section showing complete data. Tinting makes the map more valuable

tionally. Many cases will arise in which the data are so contradictory and the grade-zones so different that the interpolation is at best a guess. Each case when it arises must be considered separately and the interpolation made which seems most reasonable. Quite generally, known geological conditions and ore occurrence will suggest the logical solution of such difficulties.

Theoretically, the assumption on which this method of interpolation is based, is that an ore zone in one hole carries through to the next on a straight line, either widening or narrowing as the case may be to a corresponding zone in an adjoining hole. Practically, there are many considerations which influence this extension from the hole of either ore or waste, and the assumed straight line may be actually crooked or irregular. For instance, two holes may be driven into different formations in which the ore occurrence is known to be decidedly different, in which circumstance the conclusion is forced that the line bounding the top or bottom of the ore is anything but straight. At this point a clear conception of the structural geology of the ore deposit will be of great assistance in determining the lines on which the ore boundaries are drawn.

Graphic Methods Used

A separate card such as Fig. 3 is prepared for every interpolation, and as there are several hundred such cards, they must be arranged so that any desired card can be found without delay. A simple way of making this arrangement is to stamp at the top of each card the lower number of the two drill holes on the card. If the cards are arranged bookwise, in order of the stamped numbers, even though several numbers fall together, it is easy to find any one desired.

With the necessary map and forms made up as shown in Figs. 1 to 3, work may begin in preparing the sections, an example of which is shown in Fig. 4. This figure is always made up entirely on tracing cloth. In the beginning, forms are made on a standard scale carrying the necessary horizontal and vertical lines; these are numbered consecutively. Then the form is applied to Fig. 1, with any horizontal line coinciding with the line on Fig. 1, corresponding to the section being made. The surface profile is "shot" in from the contours and the surface geology is indicated. Next it is just as well to draw in the complete geology of the section as nearly as may be known from the surface geology and the data furnished from the churn-drill logs. Next are drawn the heavy vertical lines, such as indicated by the numbers 64-69, 143-156, just above the profile. These vertical lines represent (see Fig. 1) the trace or line previously referred to where the vertical section cuts the planes between the various drill holes. This particular section has ten such traces. We already have the traces drawn in the series of cards made out as per Fig. 3. The same scales are used. Each of the traces is transferred to the section by tracing with lead pencil on the corresponding heavy line on the section. When all have been treated thus in turn, the ore zones are sketched in and the necessary permanent lines are inked.

White Prints Permit Tinting

In this manner we show on the section the outlines of the various zones, depending on grade, that make up the deposit. For the purpose of making copies of this section several methods may be followed. If it is desired to make direct prints of any sort from the section, some scheme of hatching can be worked out which will indicate the different grades of ore. However, such hatching makes a smudgy-looking print, and it is difficult to make the different grades sufficiently clear by any means of hatching which will stand out from the print. There is a method somewhat more costly in work, which shows clearly at a glance the differentiation. The method is as follows: Make a black negative and a white print. This sort of printing can be done either with a photostat machine, van Dyke paper, or some special white printing paper. On the white prints the different grades of ore may be colored so that the entire list of divisions may be seen at a glance. For instance, in this section we have six different classes or grades of ore—three different grades of oxide and three different classes of sulphide. The color scheme used is as follows: In oxide, orange is for 0.0 to 0.5 per cent, green for 0.5 to 1.0 per cent, and brown for 1.0 per cent and over; in sulphide, yellow is for 0.0 to 0.5 per cent, blue for 0.5 to 1.0 per cent, and red for 1.0 per cent and over. The colors are made up simply by diluting standard drawing inks with water and painting the different divisions with a brush. Care must be taken to thin out the colors enough so that the details of the drawing will not be obscured and yet have them thick enough to stand out. A little practice and a few trials will enable anyone to do this work, and as many copies as desired may be made from the original. Sections made in this way convey a very clear idea to anyone, and especially to those unfamiliar with the orebodies, of the shape of the various zones.

In this description of methods of making sections there has been no intention of laying down a hard and fast rule for sectioning any and all types of orebodies, but the system, properly modified, may be made to fit a large number of cases. Neither do I claim originality for the conception of the method; I really do not know who originated it. All that I claim is the perfection of a few of the details and the systematizing of the method's application.

The Analysis of Blende

A method of analyzing unroasted and roasted blende in described in *Metallbörse*, 1923, Vol. 13, p. 1182, an abstract of which appears in *Chemistry and Industry*. One gram of blende is dissolved in nitric acid (1:1) and the solution evaporated with sulphuric acid until the nitric acid and the bulk of the sulphuric acid are expelled. The mass is dissolved in water, and the solution filtered. The residue on the filter is extracted, first with ammonium acetate solution, then with concentrated hydrochloric acid. The first extract is treated with sulphuric acid to reprecipitate the lead, and the filtrate is united with the hydrochloric acid extract. The residue from the latter treatment is reduced in hydrogen, the metallic tin dissolved in hydrochloric acid, and the filtered solution added to the previous acid liquid. The insoluble gangue is then ignited and weighed.

In the sulphuric acid solution the hydrogen sulphide group is precipitated and the arsenic, antimony, and tin are separated from the copper and cadmium and added to the hydrochloric acid fraction. The constituents of each fraction are then separated and determined as usual. Details are also given for determining the total sulphur, sulphate sulphur, and sulphide sulphur as well as that occurring as barium sulphate.

Discussion

"Engineering and Mining Journal-Press" is not responsible for statements or opinions published under "Discussion." In many cases the views expressed are diametrically opposed to editorial policy and belief.

How Was Placer Gold Formed?

THE EDITOR:

Sir—In your issue of March 8, in the article of Mr. Henry S. Hazlitt on "Origin of Ore Deposits," the following occur: "No extensive placer deposits of nugget or coarse gold have been found outside of the limits of glacial erosion." "It is my impression that the southern limit of the coarse gold placers of the Pacific Slope is Mariposa County, Calif." Now, the writer is of the opinion that Mr. Hazlitt is in error on both of above statements. Some pretty coarse gold has been found at several points on the San Joaquin and Kings rivers and at various places in Kern County, but more particularly at several places on the Mojave Desert.

Only a few years ago a Mr. Valentine found a nugget, of value about $2,200, near the head of Bonanza Gulch. Two nuggets previously found in this gulch were valued at about $1,900 each; and, according to Rudolph Hogan, an old resident, there have been many nuggets, ranging in value from $50 to $150, taken from Bonanza and other gulches tributary to Red Rock Canyon. Also, the Galen district supplied some fine nuggets and much coarse gold.

I have not seen anything that indicates any glacial erosion in this portion of the country. Galen lies to the southeast and Bonanza to the west of Black Mountain, an old volcano. And most of the placer gold at and between these two points was associated with volcanic ash. My friend J. B. Clifton took out three nuggets, aggregate value something over $1,100, from another gulch near the head of Bonanza. At the point where Mr. Clifton worked, it was from twelve to fourteen feet to bedrock; it was all angular fragments, no wash gravel at all, but for fifteen or sixteen inches above the bedrock was volcanic ash, and there is where the gold was found. As he used a dry washer, he saved only coarse gold.

Now, my idea is that this placer gold had its origin in Black Mountain, but I do not believe these nuggets and coarse gold were ejected from this volcano of the size in which gold was found, to be carried from one to five or six miles and to land along with the light materials of the volcanic ash. I am of the opinion, rather, that it was ejected in an easily soluble, chemical form along with the volcanic ash, from which it was later leached out and precipitated in the form of nuggets and coarse gold, near where it was found.

I am of the opinion that much of the placer gold never came from quartz leads in the metallic state; that it is precipitated in the compact gravels where found, much on same principle that it is precipitated from the aqueous solutions in the filling of mineral veins. I have seen in placers thin sheets of gold from an eighth to a quarter inch, with square corners and not thicker than a sheet of writing paper. A placer specimen, in the Mining Bureau of San Francisco, consists of six or seven leaves each about one-half inch square and about as thick as a postal card, standing upright on an irregular gold base, and the leaves pointing nearly toward a common center. This specimen was certainly formed right where found.

Having occasion to get into an old tunnel that had not been worked for thirty-five or forty years, the open cut leading to the tunnel was found filled with dirt and rock and the water was about thirty inches deep in tunnel. The water percolating through this dirt carried in solution considerable iron, which upon coming in contact with the air was oxidized and precipitated. The old drain ditch was nearly full of iron rust. I remarked to my assistant that any gold that might be in that iron rust had never come through the thirty feet of muck in the metallic state, and took a sample of the iron rust. After draining the tunnel and removing about a foot of yellow ochre, not sampled, there was found on the bottom about eight inches of blue mud. A sample of this was also taken, and upon assaying these it was found that the iron rust carried $10.50 gold and only a trace of silver, and the blue mud carried scarcely a trace of gold and 9 oz. silver.

I have often heard placer miners say: "The nearer the source of the gold, the more silver," that with distance, "the silver is leached out." According to result of above assays, it might be that there is more silver nearer the source, because the gold stays in solution longer than the silver.

As to the relations of glaciers to placers, there is one point that must not be overlooked—i.e., the tendency of any gold that mght be in solution to precipitate when the water freezes. I am of the opinion that there is more chemical gold and more chemical combinations of gold in nature than most people think. It is the generally accepted theory that in gold-bearing sulphides the gold is in the metallic state and surrounded by the sulphide. This is probably true in most cases, but it is certainly not true in all. I have seen sulphides and also sulpharsenides, as well as several other combinations, including tellurides, that can be rubbed up as fine as flour and examined with a strong magnifying glass without seeing a particle of anything that looks like gold, and yet, take these same ores, without rubbing up, treat them with nitric or sulphuric acid, and there will be left coarse gold—too coarse to escape notice when rubbed up, if the gold was in the metallic state. It is chemically combined.

Mr. Hazlitt is probably right regarding the genesis of the copper and chrome-iron of northern California and Oregon as being in accordance with the magmatic

theory of J. E. Spurr. But if he will consult "Geology Applied to Mining" he will find that J. E. Spurr also gives many examples of mineral vein filling by aqueous solutions, a theory to which I give my endorsement.

Isabella, Calif. E. L. ALLISON.

Gold and Debts

THE EDITOR:

Sir—I note that the question of the world's gold supply has again been raised, and in a new connection. I refer to the address of H. W. Seaman at the convention of the American Mining Congress, September last, and to your editorial thereon of Oct. 20. Having written on the subject of gold, its use as currency, and the effects of that use on its production, repeatedly during the past five years, I am moved by the above named to further comments. The subject is well worth the attention of all and especially of mining men.

There is, and has been, no direct connection between the national indebtedness of the world and the quantity of gold. Gold is not the actual medium in which the debts will be paid, and it was never supposed that it would be—just as it was not the medium in which the debts were borrowed. Nominally gold is the standard in which those debts are measured in America. In the other great nations they are measured in paper currency. Only in international debts is gold the actual measure. In that case installment payments and interest may be made in gold. If the trade balance between the countries concerned (and between them and others) does not permit of payment in goods or in credit—and if the creditor country is unwilling to invest in the debtor country—then any such payments can only be effected in gold, the debtor nation having generally to buy the said gold with its goods, in the world's market, to effect the payment. But international debts are small compared with internal debts. This, however, merely means that gold is still the only international exchange medium. It infers no direct connection between the amounts of international debts and the amount of gold. In most countries there is absolutely no connection between the amounts of internal debts and the amount of gold; and these are far larger than international debts.

If there were a connection between the amount of loans—international or other—and of gold, then the value of gold would adjust itself to the circumstances. The demand for gold, like that of all other substances, is reflected in its value. If the huge national indebtedness of the world created a demand for gold, the value of gold would proportionately rise. On the contrary, gold has decreased in value, while the national debts have hugely increased. It has done so because another factor has operated. That factor is the discontinuance of the use of gold as currency by a number of nations—that is, its partial demonetization.

After 1914, when most of the great nations demonetized gold, made paper legal tender and prohibited the free movement of gold, gold ceased to control and to be the measure of value. This procedure had two main results, so far as we are here concerned. It deprived the world of a common measure of value and it decreased the use of, and therefore the demand for and the value of, gold.

If the nations are about to continue on this basis, there is no case for the artificial stimulating of gold production. If, however, the demonetization of gold be regarded as temporary, then there is a case for such support. The reasons are twofold: first, that the increase in production so caused may the sooner permit the restoration of the use of gold; second, that many mines which would be self-supporting if gold were in general use would be saved from closing down—and some of them from remaining closed. But who is likely to subsidize gold production for these reasons? The first is the concern of the nations generally. The second is the concern of the nation owning the mines concerned.

What inducements has America to so act? It is she who has maintained the value of gold where it now is for the last three years. But for her buying all gold offered at $20.67 per ounce and maintained the value of the dollar, gold would have fallen in value. It would have fallen with any fall in dollar value. She has bought gold on these terms, though her stocks of gold are greatly in excess of her monetary requirements (as she conceived them before the war). Thus gold producers have to thank America for gold having its present value.

Truly it is to America's advantage to uphold gold value. She thereby upholds the value of her foreign debts as well as of her great gold stocks. But if she were to artificially stimulate her own gold production, she would have to absorb the increased production into stock. Otherwise it would have the effect of decreasing gold value. But in absorbing it into stock, she would lose both the cost of subsidizing and the interest on the additional gold taken into stock. Unless, therefore, she anticipates the other nations restoring the use of gold and is willing to increase her gold stocks for that reason—because the other nations will later require, and will buy, the surplus—it would seem very bad business on her part to so act. In this connection it should be remembered also that the bigger the gold stocks the less value will gold have per unit of weight when the time comes to sell.

It would benefit America, as well as all other nations, to have gold re-established. Her over-seas trade would benefit, and the improved economic conditions that would follow re-establishment would probably enable her debtors to pay her. But it is to be supposed that the debtor nations will hesitate to take a step that will increase the burdens of their indebtedness—through increase of gold value. This may prove one of the obstacles to restoration. Meanwhile, increased production of gold must have a tendency to cheapen gold, a tendency to be checked only by America in the way above described.

The only other inducement that America has, is to assist her gold mines. The amount of wealth production represented by the increase in gold production caused by artificial stimulation would be an insignificant matter compared to America's total wealth production—and a small matter compared to the value of her foreign debts and her gold stocks. This inducement, on the grounds of national economics, is insufficient.

What reasons has the British Empire artificially to support its gold production, supposing that the empire would act as a whole in this matter?

The restoration of gold is of the utmost importance to Britain. The lack of an international measure of

value and exchange medium has undoubtedly injuriously affected her foreign trade, and her welfare depends greatly on that trade. The want of an international exchange medium is a greater loss to her than to any other nation.

As things now are, the effect of the empire artificially assisting its gold production would be to send more gold into America's stocks—at the price of $20.67 per ounce. The only way in which such a process could be expected to aid the empire toward restoration is that the increased growth of those stocks might induce America to inflate the dollar (lower its value) to discourage the gold inflow. Such a reason is most unlikely to influence the governments concerned. It is most improbable that such increased gold inflow would cause America to alter her monetary policy. The inflow would be a negligible factor, compared with America's national income or with that country's economic stability.

On the first reason, then, the empire would have little inducement, it is plainly apparent, to subsidize gold production.

The second reason is a substantial one. The gold mining of the empire is a great industry. But it is a senseless thing to artificially assist an industry if the reasons for its shrinkage are permanent. If temporary, such assistance may be wise. The shrinkage of the empire's gold production is the result of a decreased demand for gold. The future demand will depend on the world's future monetary policy. The latter will determine whether the factors that have decreased gold value are permanent or temporary. If the governments of the empire believe that gold restoration will come within a reasonable period, it might be a sound policy to assist the gold mines over the intervening period. If they do not so believe, it would be a futile policy to assist them, however great an industry they represent. Whatever may or may not be a wise policy in this respect, there is no sign that the governments concerned have been considered such assistance.

Other nations have no inducement to assist gold production, except that such might be expected to reduce gold value. They have no great gold industry to assist. Reduced gold value would lessen the burden of foreign indebtedness and might be thought to hasten the day of gold restoration. The nations to which these considerations would appeal are not able even to balance their budgets and certainly will not add to their present burdens by subsidies to gold mining. Even if they did, we have seen that the effects would probably not be what was sought.

So it appears that the prospects of any government aid to gold mining are dull indeed, and that the case for such aid is a slender one. H. R. SLEEMAN.

Perth, Western Australia.

Crepe Rubber for Launder Lining

THE EDITOR:

Sir—Adding further to my letter of Nov. 13, published in your issue of Jan. 5, I notice that the trunk of the launder is given as 6 in. wide and 18 in. long. Obviously it should read 6 ft. wide and 18 ft. long. The photograph published was of the actual mat used to pave the launder. ROY L. NAISH.

Kamunting, Perak, F. M. S.

"A Department of Mines"—A Question of Politics

THE EDITOR:

Sir—There is much to admire in the character of recent *Mining Journal-Press* editorials; especially in a day when strict honesty and plain truth, combined with clear vision, are too frequently sacrificed on the altar of expediency—or that policy which disregards every ethical principle in the sordid craze for material advantage.

In your issue of April 19, your discussion, "The Interior Department in a Politician's Hands," is the sort of thing which seems to be sorely needed by the American public. In the same issue, under "Discussion," another timely article is headed "Against a Department of Mines"; and the nameless author of this essay, with some further thought, might have added several other specific examples of government meddling which are tending to put a final quietus upon the business of mining.

We all know that the apostle of strict justice today (as, perhaps, has been always the case) becomes the immediate target of wholesale criticism and abuse; he is termed "a dangerous radical," or something equally opprobrious, so that, unless he be something notable in the way of a real man, he is likely eventually to seek a new job.

However, some of use recognize the futility of the average human life-work, and wish very strongly that opportunity had been given us to accomplish just a few things really beneficial to our fellow man, instead of dancing through "life's fitful fever" solely occupied with more or less petty and ephemeral selfish aims; and the knowledge of such accomplishment might go far in the way of compensation of the unpleasantness of criticism.

Thus, I am tempted to suggest that the *Mining Journal-Press* go just a bit farther in its clean-cut consideration of political issues, with the idea in mind (if excuse be needed) that, if any earthly enterprise needs help, by correction of annihilating conditions, it is the business of mining. Referring again to the article, "Against a Department of Mines," and its quotation from Mr. Beveridge's St. Louis speech, we are forced to acknowledge that the various indictments are true. Careful consideration leads to a suspicion that practically all political offices are held as sources of personal gain, and such gain not always or often limited to the salaries paid.

If one contemplates the meaning of the word "patriotism," it would seem that a federal employee, under his oath of office, must handle the affairs of his country with much the same refined reverence with which he should regard the affairs of his mother; and that any other sort of handling might verge very close to treason. Further consideration advises us that the sinister conditions referred to in the article mentioned above are not the result of the people's will, but of that vast and supremely sordid system of partisan politics against which Washington warned us, as "the most dangerous enemy of our republic."

And this prompts the suggestion that the *Mining Journal-Press* advise its readers as to just why are political parties in any way necessary to the well-being of the country? F. C. SMITH.

Chloride, Ariz.

Consultation

Uses and Value of Beryl

"Will you please tell me something about beryl, particularly about its use and value? I can find very little information regarding this mineral, with the exception of a few references to its occurrences quoted in the various text books on mineralogy."

Beryl is a non-metallic mineral found in granitic pegmatites and related formations. It is a beryllium aluminum silicate having the composition $Be_3Al_2(SiO_3)_6$ and is colorless when pure—its most valuable form. Gem varieties are known as aquamarine, emerald, morganite, and golden beryl. If pale-blue or green-blue it is classed as an aquamarine; when intensely green, as an emerald; yellow, orange, or orange yellow, as golden beryl; the pink variety as morganite. All these varieties must have transparency to be valuable as gem stones; the emerald is generally of greatest value.

Beryl as commonly found in New England is opaque, with a pale green color, and has a value on a pound or tonnage basis only. Connecticut, Maine, Massachusetts, New Hampshire, North Carolina, California, and other states have beryl deposits.

Owing to the fact that until recently no use has been found for the mineral, beryl mining has languished for a market. Occasionally small sales have been made, generally to be shipped abroad to German consumers. It is believed that some European metallurgical establishments are interested in the extraction of beryllium metal from beryl, although what commercial application may be made of beryllium we have not been able to discover. It is known that some beryl is used to manufacture beryllium salts, and there may be an application of beryllium to steel manufacture.

Market prices for beryl, owing to the limited demand, are nominal. Sales are few and far between. The mineral in the form of brownish green crystals has been sold for 4½c. per lb. and can be bought for less today. Ordinarily it is recovered as a byproduct in the mining of feldspar and mica, each of which has a well-developed market. The beryl is sorted by hand to furnish a clean product. Should a market become established for this non-metallic mineral, production can be increased.

Beryllium metal, also called glucinum, is one of the lightest metals known. It is slightly heavier than magnesium. Experimenters have been hopeful of using beryllium's characteristic lightness in alloying it with other metals, especially copper. We do not know what success has attended the efforts of these experimenters. One compound of beryllium is used commercially—the nitrate. It is used in combination with thorium nitrate to strengthen the mantles used for incandescent gas lighting. It is said that beryl makes a satisfactory refractory material, and if it were more abundant would be used for that purpose in special cases. Doubtless additional uses for beryl and beryllium will be found, and miners of this mineral will be assured of a steadier market.

Two papers have recently been published on beryllium, one "The Electrolytic Production of Beryllium," by Hopkins and Meyer, the other "The Metallurgy and Alloys of Beryllium," by Hopkins and Engle. Both are published by the American Electrochemical Society.

Cobalt Compounds

"Will you advise me where I can obtain information regarding the use of cobalt oxides and other cobalt compounds in the ceramic industry?

"What compound of cobalt is mostly used for this purpose?

"What producers are there of cobalt oxide besides the Coniagas, Deloro, and Nipissing companies?

"You occasionally quote the price per pound for cobalt oxide in barrel lots. Could you tell me the amount in a barrel? I shall be much obliged for any help you can give me."

The Bureau of Mines Experiment Station at Columbus, Ohio, is devoted to research in the ceramic industries. This station doubtless has information relative to the use of cobalt compounds in pottery and crockery manufacture.

Cobalt oxide is used to produce a blue glaze in enamels and porcelains. The salts of cobalt are of small commercial importance and may be obtained by proper chemical treatment of the oxide with acid. Cobalt oxide is supplied in two grades, black and gray, the former carrying the lower price and being less pure than the gray. The oxide enters into the composition of several cobalt pigments used in paint manufacture and the decoration of pottery. Of these pigments, smalt, cobalt blue, coeruleum, new blue, cobalt green, and cobalt yellow are important.

Smalt is a blue pigment, essentially a potash glass containing dissolved oxides of cobalt and other metals. It analyzes about 70 per cent silica and 20 per cent potash, the remainder being varying amounts of cobalt oxide and alumina. When first marketed it was prepared directly from cobalt ore, but is now generally obtained from roasting speiss. This is fused in pots with potassium carbonate and silica. The smalt rises as a slag and is ladled off. It seems that the cobalt is the only constituent of the speiss slagged; the arsenides remain in the residue at the bottom of the pots. Cooled smalt is ground to be sized according to the requirements of the trade. The color of the smalt may be varied by the introduction of various impurities such as manganese, nickel, iron, zinc, bismuth, copper, antimony, and other metals, or mineral substances. Iron dampens the brightness of the brighter-colored smalt. Manganese gives a violet tinge, barytes an indigo, and soda, lime, and magnesia a reddish tinge.

Cobalt blue is a mixture of cobalt and alumina. It may contain the phosphate or arsenate of cobalt. It is one of the most permanent blue pigments inappreciably affected by acids or alkalies, and mixes satisfactorily with other pigments. Its principal use is as an oil or water-color paint.

Cobalt green contains oxide of cobalt and zinc. Its color varies according to the relative proportions of these two constituents and the amount of impurities present. The cobalt oxide present usually amounts to 11 or 12 per cent.

Coeruleum is a light-blue pigment containing roughly 18.5 per cent cobalt oxide and 50 per cent tin oxide, the remainder generally being some inert material. It retains its color in artificial light—something that the ordinary cobalt blue will not do.

The two principal producers of cobalt and its compounds are the Deloro Smelting & Refining Co., Deloro, and the Niagara Alkali Co., of Thorold, Ont.

Cobalt oxide is sold in barrels of 500 lb. gross or in cases of 200 lb. gross.

News of the Week

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Summary

W. G. ROSS, president of the Asbestos Corporation of Canada, paints a gloomy picture of the Quebec asbestos industry. He advocates government action as the only practical remedy.

Operations of the United Comstock Mines Co. at Gold Hill, Nev., realized a working profit of $64,285 during the first quarter of 1924.

Increase of the dividend rate of the Golden Cycle company, in Colorado, from two cents to three cents indicates greater prosperity in gold mining.

The new 100-ton flotation concentrator of the Eureka-Holly Mining Co. at Eureka, Nev., is in regular operation at full capacity.

Domestic quicksilver mining has improved greatly, due to the stimulus of increasing prices for the product.

Despite the adverse decision in the suit with the Northern Canada Power Co., the Hollinger Consolidated is continuing work on its new hydro-electric plant.

A novel contract has been made by the Silver Mountain Consolidated Mining Co. whereby ore from its property in Stevens County, Wash., will be mined and milled for $6.50 per ton.

A movement is on foot at Washington to end the investigation of the Senate gold-silver inquiry on the ground that the expense is not warranted.

The Keystone Mining Co. is shipping lead-silver ore and concentrate regularly from Park City, Utah.

Developments in the West Dome Lake and Crown Reserve mines, in northern Ontario, forecast the building of mills.

Two New Mills in Prospect for Northern Ontario

West Dome Lake and Crown Reserve Development Looks Good—Additional Funds Needed

Two mining companies in northern Ontario will soon be in the market for additional funds to carry on further work. The West Dome Lake shaft will in a short time reach the 1,050 level, and development below 600 ft. has been very satisfactory.

On the 750 level an oreshoot has been drifted on for a length of 300 ft. and shows a grade of $10 over 5 ft. At 900 ft. the ore has been crosscut, but no drifting done. At the intersection assays show $20 over 5 ft.

Within the next three months it is believed that enough development will have been done to justify the reopening of the mill, and by that time the company will know how much money will be necessary to put it on a profitable producing basis.

The Crown Reserve Co., which is opening up a property in the Larder Lake district, will also require additional capital in the near future, and another block of treasury stock will be offered to the shareholders. Recent developments have been quite satisfactory, and though the average grade of the ore developed to date is not as high as originally anticipated, there appears to be enough tonnage of sufficient grade to insure a profitable undertaking.

It is expected that within the next three months a decision will be reached as to the size of the mill necessary.

No General Shortage of Miners in Colorado

Press reports of a labor shortage in Colorado metal mines are not in accordance with the facts. Cripple Creek operators are taking on more men, and first-class machine men are in demand; probably fifty men could find jobs in that camp. Other mining districts report an ample supply of labor and no immediate prospect of a change in the wage scale. The following is the Cripple Creek scale, and in some instances it is 25c. below that of other Colorado camps:

Engineer, first-motion hoist	$5.50
Engineer, geared hoist	4.75
Machinist	4.75
Blacksmith	4.75
Blacksmith helper	4.25
Timberman	4.75
Machine miner	4.75
Cage tender	4.25
Mucker and trammer	4.00
Ore sorter	3.75
Pumpmen	5.00

Practically all camps report a slight increase in mining activity, compared with a like period last year. The Durango smelter is handling a record tonnage of ore, and the Leadville plant reports a large increase in tonnage.

Quicksilver Mining Is Stimulated by Better Prices

Domestic Output Estimated at 1,200 Flasks per Month—Four California Mines Are Producing

Although the current year opened with a soft quicksilver market, and prices sagged considerably, a noticeable stiffening in the price situation recently has encouraged the quicksilver miners in California and other western states. This has been due to increased demand. The price is now around $78 per flask. Incidentally Spanish production has been sold a long way ahead, and the present situation is favorable for the domestic producers.

The Helen, New Almaden, New Idria, and the Cloverdale mines are producing. The Gold Banks, in Nevada, and Chisos, in Texas, are also producing. Several small properties and prospects as well as a few of the older mines are preparing to start. Aggegate production for the United States has increased from about 800 flasks to approximately 1,200 flasks per month. About 500 workers are now employed in the industry.

An effort to get domestic producers to place 76 lb. of quicksilver in their flasks to accord with the European standard of 34.5 kg. has failed, and producers, excepting one, are marketing 75 lb. of quicksilver per flask. Imports during the early part of this year have been light.

Oglebay, Norton & Co., Iron Ore Miners, Incorporate

Old Firm Manages Many Mines—Owns Fleet of Iron-Ore Boats—Has Taken Over Fluorspar Mine

Announcement has been made by Earl W. Oglebay, David Z. Norton, and Henry K. Bourne, who have been doing business as a copartnership under the firm name of Oglebay, Norton & Co., that they organized under the laws of the State of Ohio a corporation of the same name, which will, on and after May 1, 1924, take over and manage the business theretofore conducted by the partnership. The firm is well known in the iron mining industry, as it has been doing business as iron-ore broker and mine manager since 1889, at which time it succeeded to the business theretofore conducted under the firm name of Tuttle, Oglebay & Co. The original business was founded about fifty years ago with the name H. B. Tuttle & Co.

The company's principal mining office in the Lake Superior iron-ore country is at Ironwood, Mich., and is in charge of E. W. Hopkins, range manager.

There will be no change in the personnel of the new company, as the management will be conducted by the same executives who have been in active charge for some years.

The company acts as operating manager for the Montreal Mining Co. and the Castile Mining Co., with mines on the Gogebic range, and for the Bristol Mining Co., the Brule Mining Co., and the Fortune Lake Mining Co., with mines on the Menominee range. It also sells the product of the above-named companies as well as the output of several other iron-ore mines.

The Lake transportation department of the business is known as the Columbia Steamship Co., which owns eight modern steel freighters having a total carrying capacity of 73,500 tons. An order has recently been placed for the construction of a new steamer, of 12,000 tons' capacity, to go into commission in the spring of 1925.

The company has recently taken over the supervision and mining operations of the Rosiclare Lead & Fluorspar Mining Co., one of the largest fluorspar-producing companies in this country, with mines in Hardin County, Ill., and Crittenden County, Ky.

The directors of the new company are: Earle W. Oglebay, David Z. Norton, Henry K. Bourne, Crispin Oglebay, Robert C. Norton, Rolland C. Allen, Arthur C. Bishop, Arthur E. Danforth, and William Wisner White.

Central Eureka Provides for Reversal of Ventilating Currents

The installation of ventilating equipment underground has been completed by the Central Eureka Mining Co. of Sutter Creek, Calif. The installation, designed by W. S. Weeks, provides for two fan units electrically controlled at the motors and by switches at the surface. One fan serves for the normal ventilation of the mine and the other is to be used in emergencies when it is necessary to reverse the ventilating current.

Meet Radiophone Station WWAO: Michigan College of Mines!

Broadcasting from the new radio station of the Michigan College of Mines at Houghton, Mich., has been successfully established. The station is known as WWAO and has an effective radius of a thousand miles. M. G. Sateren supervised the erection of the antenna and transmitting equipment. Two evening programs are broadcast each week, among the features being discussions of the mining operations in the Michigan copper country. Each day at 11:15 a.m. market and weather reports and music are broadcast. The many alumni of the college feel that the scheme should serve to advertise their institution.

As in "Stud" All Depends on What Is in the Hole

Special Correspondence

The old Blue Bird mine, south of Lordsburg, N. M., that has a record for producing gold-silver and copper ores, has been taken over by local capitalists and is being worked. A new company has been organized to handle the project, to be known as the Four Ace Mining Co. Fat Hoy, "Lordsburg's leading merchant," is president, and "Chicken" Smith is mining engineer and purchasing agent.

The board of directors consists of well-known citizens and leading politicians of southwestern New Mexico. According to the company's letterhead, Mart Hardin is "Consulting Lawyer and Legal Advisor," Bill Downey is "Superintendent of Transportation," G. F. Conroy is "Construction Engineer," Willard Holt is "Publicity Manager and Toastmaster," Dr. Banks Austin is "Physician and Surgeon," John Augustine is "Insurance Agent and Claim Adjustor," and Jack Head is "Special Officer." The principal office is at 1111 South Pyramid Avenue and the telephone number is Main 11,888.

It is not stated whether the company was named because of the address of the office or whether the location of the office was selected because of the name of the company. At any rate, the enterprise seems to be tinged with the great American game in which five cards make a hand.

Cottrell Plants "Insulated," Arizona Radio Fans Again Happy

The interference of the Cottrell precipitation plants with radio reception has been successfully eliminated at smelting plants in Arizona districts. J. F. Dillon, radio supervisor for the federal government, has been visiting Miami, Superior, and other towns in Arizona where smelters are equipped with static apparatus, and has co-operated with the management of the plants in effecting changes that remove the disturbance. Previous to the visit of the government expert numerous petitions had been sent to Washington asking that steps be taken to remove the interference so that residents near smelters could enjoy the radiophones as much as the more fortunately located fans.

Keystone Ships Regularly From Park City, Utah

Ore and Concentrate Average 40 per Cent Lead, 15 Oz. Silver—Good Profit in First Quarter

Shipments have been resumed from the Keystone mine at Park City, Utah, adjoining the Silver King Coalition property, after an intermission caused by bad roads. The mine is now ready to ship at the rate of 12 to 15 tons of concentrates and 35 tons of direct smelting ore daily. The latter averages 40 per cent lead and 15 oz. silver, and the concentrates run about the same, though they carry somewhat more silver.

About 1,000 tons of ore and concentrates has been stockpiled, awaiting better shipping conditions. Work is being pushed to complete the K.K. winze, which is to connect with the 400 level, the lowest in the mine, and which, when completed, will make it possible to hoist the ore more directly to the Hanauer tunnel, at the portal of which are situated the mill and loading bins. Later it is expected to sink below the 400.

A net operating profit of $80,000 is stated to have been made during the first quarter of 1924, under the handicap of bad roads and more or less intermittent shipments. The property, which is controlled by the Bamberger interests, was involved in litigation with the Silver King Coalition. This matter was settled about a year ago and production has been fairly regular since that time.

One Killed, Four Hurt, in Mine of New Jersey Zinc Co.

Drilling into an old socket caused the death of one man, the serious injury of another, and slight injury to two others in the Franklin mines of the New Jersey Zinc Co. on April 23.

William Jurchyk, working as drill helper, was killed. The drill runner, Samuel Kosminsky, is in Franklin Hospital with internal injuries that may prove fatal. Wasil Diba, a mucker, sustained contusions of the head, and Thomas Wilton and Richard Robert, mine bosses, suffered lacerations.

Kosminsky had been employed on work of this kind for the company for the last ten years. He had started drilling some distance from the mouth of the old hole, but evidently had drilled downward at an angle that brought the drill into contact with the unexploded powder. Thomas Wilton was in charge of the work and stood near by.

Great Western Mill, at Rochester, Nev., Restarted

Milling was resumed at the Great Western mine, in Lower Rochester, in Nevada, soon after the middle of April. The mill had been closed down during the winter months, but mine development was continuous. The vein is small, but of high grade, with practically all values in gold. The amalgamating plant handles only a few tons of ore per day, but sufficient to make a good profit for the owners.

Golden Cycle Increases Dividend Rate From Two Cents to Three Cents

AT THE regular monthly meeting of the Golden Cycle Mining & Reduction Co., held the latter part of April, the quarterly dividend rate was increased from two cents to three cents. The company operates a cyanide plant at Colorado Springs, which treats more than 20,000 tons of Cripple Creek ore monthly; owns and operates coal mines near Colorado Springs which supply fuel to the Cripple Creek district; owns a controlling interest in the stock of the United Gold Mines Co., and valuable real estate in Colorado Springs.

The Golden Cycle company is headed by A. E. Carlton.

Wage Bonus Planned to Speed Work on Moffat Tunnel

To speed up work on the Moffat tunnel, a six-mile bore which is being driven through the main range of the Rocky Mountains to reduce grades on the Moffat railroad, a bonus, beginning May 1, will be paid the workmen in the water tunnel and the headings of the railway tunnel. The water tunnel or pilot bore is being driven ahead of and parallel to the main opening. At intervals as the water tunnel progresses, crosscuts are run to the main tunnel, and headings driven each way.

The bonus is paid upon an average of over 17 ft. a day, and is graduated above 17 ft. in proportion to the wages received by each man on the work. It will be paid only to those who work their regular shifts during the period except when off for sickness or injury.

Snowstorm Mines Co. Installs New Equipment

The Snowstorm Mines Consolidated, operating near Troy, Mont., is installing a 100-hp. hoist and a two-ton automatic skip. A winze from the No. 7 level, 200 ft. in depth, has been completed, and a station is being cut. A vein 3 ft. wide, carrying 26 per cent lead, 6 oz. silver, and 0.05 oz. gold, has been cut.

Geological conditions are changing, according to officials. The ground at the bottom of the winze resembles the Burke quartzite found in the Coeur d'Alene region in Idaho. The upper levels of the mine are in slate.

Surprise Will Sink to 1,200 Ft. at Republic, Wash.

A contract has been let by the Surprise Mining Co., of Republic, Wash., which is owned by the Northport Smelting & Refining Co., to sink an additional 500 ft. in the 700-ft. shaft on the property. This will be the deepest exploration ever attempted in the camp, which until recently has placed the limit of commercial ore at about the 600 level. The Northport Smelting & Refining Co., owner of the Surpise mine, is controlled by the Day interests, of the Coeur d'Alene district.

W. G. Ross Paints Gloomy Picture of Quebec Asbestos Industry

Urges Government to "Establish Price at Which Exports Can Be Made"—Co-operation Impracticable

AT THE annual meeting of the shareholders of Asbestos Corporation of Canada at Montreal on April 30, W. G. Ross, president, reviewed at length the unsatisfactory production and market conditions of the industry, stating that the results of the coming year were likely to prove disappointing. Co-operation between the companies had been proposed, but he regarded this as impracticable. The mines owned by American manufacturing interests would not co-operate, and some of them, after their own requirements had been satisfied, threw their surplus on the market, to the detriment of others engaged in the industry—preventing to some extent the obtaining of living prices. The higher grades were affected by foreign and Empire competition, which had the advantage of low labor costs and freedom from winter conditions.

Then the endeavor of most of the other mines to keep operating at any cost, by price-cutting without proper realization of the true value of their properties, makes it prohibitive even if it were desirable to deal with them. It would appear therefore, continued Mr. Ross, that possibly the only effective solution is government intervention, whereby regulations as to production and prices would be enacted. Request for this procedure has been urged upon the government.

The attitude of the Provincial Government of embarrassing the industry by a high royalty tax on the legitimately owned Canadian companies puzzles Mr. Ross, who declares that this tax is probably the most drastic one on any industry the world over.

A long step in the direction of curing the evil conditions prevailing would be government assistance, especially in establishing the prices at which the product may be shipped out of the country. This would place all, both American and Canadian companies, and both miners and consumers, on the same basis, and would be of immense benefit to the province. This had been done by the British, German, and Italian governments, and there is no reason why the Canadian Government should not follow the same course, according to Mr. Ross.

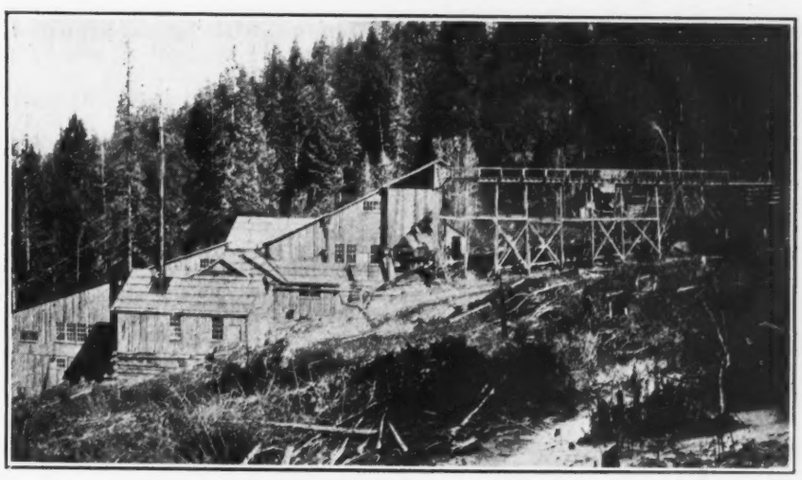
Silver Mountain Contracts Operation of Its Mine and Mill

The Silver Mountain Consolidated M. & M. Co., operating in Stevens County, Wash., has recently let a contract somewhat out of the ordinary. It provides for the development, mining, and milling of the ores of the mine and specifies that the contractor is to mine the ore so that the minimum grade shall not be below 15 oz. silver per ton. The contractor will mill it in the new concentrator recently erected by the company.

No provision is made as to the percentage of saving that must be made in the mill except for a clause providing that due care conformable with usual practice must be exercised. The contract calls for $3.50 for mining, $3 for milling, and $5 per ton for hauling concentrates to the railroad, a distance of 23 miles.

Round Mountain Starts Hydraulicking

The Round Mountain Mining Co. started its placer hydraulic season at Round Mountain, Nev., about the middle of April, and at present two giants are in operation. Snowfall in the watersheds from which the company derives its water was quite satisfactory, and indications are that a successful season has been started.



New concentrator at the Silver Mountain mine

An unusual plan for contracting the mining and milling of the ore has been made. The property is in Stevens County, Wash.

News from Washington

By PAUL WOOTON
Special Correspondent

Some Senators Regard Gold-Silver Inquiry as Unjustified Expense

Supporters Feel That Abrupt Discontinuance Would Nullify Value of Work Done—Employment of Specialists Necessary Because of Intricate Problems

AN EFFORT is to be made by certain members of the Senate to terminate the work of the Commission of Gold and Silver Inquiry. The inquiry of the commission is costing $4,500 a month. The entire study up to April 15 had resulted in expenditures of $56,409.86. This has aroused the opposition of certain Senators, who are preparing to register their objections on the floor of the Senate. In that connection, it may be mentioned that these same Senators, who are so circumspect when money is being expended on research into phases of the mining industry, have sat in silence when appropriations have been voted in excess of those asked or desired by the Department of Agriculture. Were the gold and silver inquiry terminated abruptly at this time, much of the work in progress would be lost.

Advocates of the inquiry declare that the field hearings of the commission have been concluded and there remains only the editing of the testimony and the preparation of a brief report covering these hearings to bring this part of the commission's investigation to a conclusion.

That part of the commission's investigation which deals with the cost of production, investment, and yield on investment is still in progress. The questionnaires which were formulated for the purpose of obtaining information on this subject have been sent to the principal producers. Owing to the fact that the auditing staffs of all companies were compelled, prior to March 15, to concentrate on the presentation of tax returns, many companies have been unable to make immediate return of the questionnaire. Since tax statements have been submitted, the auditors are now free to reply to the questionnaire, and these are being returned to the commission.

As received, the questionnaires are being subjected to study and data contained therein are being compiled in order to express the condition of the industry. This is the first comprehensive analysis of costs that has been made, and the commission is charged in the resolution which created it to develop detailed information on this subject. The work of compilation is expected to require several months. The commission hopes next fall to report on this phase of its investigation. The non-ferrous metal producers are co-operating in every way to make the commission's investigation a success and realize the benefits that will come from an accurate knowledge gained for the first time in this important branch of the mineral industry.

Much work has been done in connection with the commission's foreign currency and exchange investigation. Attention has been called to the adverse effects of depreciated currencies upon American trade and industry. The resolution creating the commission specifically assigns to the commission this important field of investigation.

In the course of two or three months, the commission will have completed its investigation of the currency and exchange conditions in the European countries, and a report covering these subjects will be published. A month or two later, the investigation covering the currency and exchange conditions in the countries of South America and Asia will have been completed, and a report will be published.

The importance of these studies at this time is believed to lie in the fact that they will assist this country, as well as every other country which has been subjected to analysis, in carrying into effect the recommendations of the Dawes Committee and thereby expedite return to normal financial and economic conditions.

In addition to the problem of fluctuations and depreciation, the question of a return to the gold standard involves the United States in a very close way. The United States now has more than one-half of the total monetary gold of the world and more than twice the amount of gold held in 1913. A return to the gold standard is an event which will inevitably take place sooner or later. Signs of improvement are already in evidence in some of the European countries, such as Sweden, Austria, and Czechoslovakia. Although a restoration of the gold standard is extremely desirable as contributing to a return to stability and normal conditions, such a restoration entails great responsibilities, and since the United States has such a large share of the world's monetary gold, the act of returning will necessarily affect this country. When the countries begin going back to the gold standard, a redistribution of gold will be necessary, and the United States must lose a very large part of the gold which it now has. The United States should be prepared for this event, so that the gold can be exported with as little inconvenience and disturbance to business as possible, it is pointed out. A result expected to come from the commission's currency and exchange investigation is the development of a gold policy so formulated as to assist foreign countries in returning more rapidly to the gold standard.

There never has been a time in the history of this country and the world when a careful study of these factors meant more to the maintenance of sound currency and financial conditions and the resulting prosperity of industry and trade, it is declared. The published reports of the commission's investigation will constitute an analysis of this subject, and the accuracy and thoroughness with which this investigation has been conducted are expected to meet not only with the approval of the Senate but the country at large.

These subjects which have been assigned by the Senate for the Commission of Gold and Silver Inquiry to investigate are highly technical, both in the field of mining as well as in the field of currency and exchange, and require specialized talent for their successful accomplishment. The commission has obtained the services of specialists on these subjects, upon reasonable terms of employment. Should the work of the commission be terminated abruptly, the money which has been expended in research work to date would be practically a complete loss, whereas, if the research work soon to be completed can be published it is thought the cost will not only be justified but benefits to the industry and trade of far reaching importance will result.

Michigan Copper Shipments Increase

Deliveries from the Calumet & Hecla, Michigan, and Quincy smelters, in the Michigan copper district, have largely increased, which is regarded as evidence of a quickened demand in the metal trade. At this time of the year as much Lake copper as possible is held until the opening of navigation to take advantage of the lower freight rates then prevailing. Copper now going out is consigned to consumers whose stocks are low.

Copper Range and Quincy are keeping well sold up on metal and Calumet & Hecla shipments so far this month have exceeded production for the same period. Copper is moving to the automotive centers of Michigan and Connecticut valley brass plants. Lake navigation will be resumed soon, when, it is expected, shipments will further increase.

Sunshine Mining Co. Develops High-Grade Ore in Idaho

The Sunshine Mining Co., operating on Big Creek, in the Coeur d'Alene district of Idaho, has developed an important shoot of high-grade ore on the new shaft level and will start sinking another 100 ft. about May 1. The company will also add another ball mill to its milling plant, a filter press, and two flotation units, which will increase its milling capacity to 75 tons. The company is also considering installing a new compressor of larger capacity.

The Sunshine ore contains galena and gray copper, the deeper development showing a marked increase of the former without decrease of the latter. The silver content of the ore is very high, as indicated by a recent shipment of 33 tons, which netted the company more than $8,000. The ore carried 348 oz. silver, 34 per cent lead, 3 per cent copper, and $4 in gold.

British American Co. Leases Diamond Fields in Arkansas

Newly Equipped Plant Planned in Pike County—Hydraulic Mining Expected to Cut Costs—Other Activity

By Tom Shiras
Special Correspondent

The leasing of ten acres of diamond-bearing peridotite by Walter Mauney, of Murfreesboro, Pike County, Ark., to the British American Co., adds new interest to diamond mining in southwest Arkansas. Recently Mr. Mauney stated that work on a new washing plant would start soon, and that operations would be well under way by the middle of the summer. The lease was made for a cash consideration and a royalty. This property has been worked spasmodically since 1908, and about 3,000 stones have been recovered, the largest being a steel-blue stone weighing 8½ carats.

The contemplated mill will cost approximately $50,000, Mr. Mauney says, and will be constructed so that additions can be made from time to time as the tonnage increases. No crushing machinery will be installed in the first unit of this plant. The equipment will consist of two rotary washing pans, 14 ft. in diameter, screens, jigs and grease boards.

The first work contemplated is the washing and concentrating of the top layer of weathered peridotite, which covers the surface of the property to a depth of approximately 8 ft. To this depth the dirt can be washed without crushing. When deeper operations are started crushing machinery will be installed.

The mining will be done hydraulically. A 6-in. pipe line will be laid from the Little Missouri River, three-quarters of a mile away, to the property. The water supplied by this line will be used both for washing and mining. A sluice with wide wings at the intake will be laid from the plant to the scene of operations, and the weathered peridotite will be torn up with high water pressure and run to the plant.

The Mauney tract adjoins the Arkansas Diamond Co.'s property. The large mill which this company constructed a few years ago is not now in operation, but a smaller plant is being operated steadily.

Considerable difficulty has been experienced in handling the weathered top of the peridotite. Mixed more or less with the surface formations adjoining the "pipe," it resembles a stiff gumbo, and balls up when it gets into the rotary pans. Log washers have been tried, and they have also failed to cut it. Drying in a rotary drier, then pulverizing, has also been found inefficient, on account of the small tonnage that can be handled in that manner.

Hydraulicking Serves to Break Up the Gumbo for Washing

Present operations with the small plant and hydraulic mining of this "dirt" seem to have solved the problem Operations on a larger scale are probable. Tearing this gumbo up under high pressure and running it through a rough sluice several hundred yards cuts it to pieces by the time it reaches the pans or screens.

The Kimberlite Diamond & Washing Co., which owns the Ozark and Kimberlite mines, is not active at this time. This concern has probably washed more "dirt" than any other concern in the field. It ran one plant, on "dirt" from the Mauney property, steadily from 1913 to 1919, when the plant was burned; and operated another, at the Ozark mine, from 1914 until 1919, when it was also burned. The company plans a magnetic survey in an effort to discover other bodies of peridotite in the locality. It is said that the small particles of magnetic iron present in the peridotite have an attraction for a needle.

The Ozark and Ouachita Mountains in Arkansas have bred many native prospectors—men farm in the summer time, and prospect out of crop season. John Huddleston, who found the first diamond in 1906, is such a character. Because the peridotite formation was different from anything else in that section, it intrigued him. He became obsessed with the idea that it carried gold, and purchased it against the advice of his wife. It was while searching for gold that he found the first diamond. He was not positive that it was a diamond, but believed it was. A few hours after he found the first one he found another one, in the dust of the road, while on his way to Murfreesboro. A bank cashier in the local bank offered him 50c. for the pair, but he did not sell. Instead he sent them off for identification, and his conjecture was verified.

Later a group of jewelers and business men formed the Arkansas Diamond Co. and acquired Huddleston's property and the diamond mining industry in Arkansas got its start.

John Huddleston, discoverer of the Pike County, Ark., diamond field

Hollinger, Despite Court Decision, Proceeds With Power Development

Tried to Affirm and Deny Contract in One Breath—Must Buy from Northern Canada Co.

Special Correspondence to Engineering and Mining Journal-Press

In spite of the decision for the plaintiff in the action for specific performance brought by the Northern Canada Power Co. against the Hollinger Consolidated and the Canadian Mining & Finance companies, the Hollinger company is proceeding with the construction of an extensive power development. The decision in effect states that the Hollinger must take all its power from the Power company for the life of the mines.

One of the most embarrassing features which the Hollinger had to contend with was the action brought by that company against the Northern Canada Power Co. for damages due to failure to supply power. The court takes the stand that this implies the presence of a contract and states that litigants ought not to be affirming and disaffirming in the same breath. The action arose out of the fact that the Hollinger claimed that no valid contract existed and began plans for the construction of a hydro-electric plant of its own on the Abitibi River.

Though there was a signed agreement to enter into a formal contract for the purchase of all the Hollinger power requirements for the life of the mine, this contract, through some oversight, was never actually completed, but the court is of the belief that both parties acted as if such a contract existed and that the Hollinger made demands for more power and encouraged the power company to go ahead with large expenditures for development.

Type of hand washers used in the Arkansas diamond-recovery operations

Eureka-Holly Mills 100 Tons Daily in New Plant

THE Eureka-Holly Mining Co. started its 100-ton flotation plant, beginning on a small scale, on April 8, and is now operating two shifts, treating 100 tons of ore per day. The surface accumulations are now being milled, and there is said to be sufficient ore in these dumps to last for at least three months on present scale of operations.

On account of delay in shaft sinking, due to the fire which practically destroyed the mine surface plant two months ago, the original plan to sink to the 1,150 level before doing any lateral work has been abandoned. The shaft is now 825 ft. deep, and as soon as the surface plant is completed shaft sinking is to be resumed and stations will be cut at the 750 and 900 levels, and crosscuts driven to the projected position of the orebodies. There is also said to be a large amount of ore of milling grade available in the adjacent Bullwhacker mine.

First Thought Plans Cyanide Plant

O. J. Smith, in charge of the operation at the First Thought mine, near Orient, Wash., has announced that a cyanide mill will soon be installed on that property. Mr. Smith says that the project is fully financed by a London syndicate which has purchased a large block of stock in the mine. The First Thought was a producer of gold ore several years ago, being operated and owned by the Burns interest, of Canada.

Oscar DeCamp and associates, operating the Bella May, Blue Bucket, and Diamond R. claims, in the Metaline district, in Washington, are shipping high-grade lead ore to the A. S. & R. smelter at East Helena. They have maintained steady shipments all year averaging 70 per cent lead.

Reserve Mine Near Luning, Nev., Ships 18 per Cent Arsenic Ore

The Reserve arsenic mine, 3½ miles from Luning, Nev., has broken into the ranks of the producers. On April 15 the first car of ore was shipped to the Hazen sampler of the Western Ore Purchasing Co. for sampling before sending to the Arsenic Refining & Products Co. at Martinez, Calif. The car averaged 17.8 per cent arsenic. Up to April 20 three cars had been shipped, of approximately the same grade, and more is to follow.

The Reserve mine is under bond to L. B. Spencer, of Mina, and W. O. Woodbury, of Reno, and is being operated by them. The ore occurs as a replacement in limestone, as scorodite, near a limestone-granodiorite contact. Several prospects are being developed along the same contact, and Luning bids fair to become an important shipping point for arsenic ore.

Peirce-Smith Converter Co. Wins Patent Infringement Suit

In the United States District Court at Wilmington, Del., on April 23, Judge Morris handed down a decision in favor of the Peirce-Smith Converter Co. in its infringement suit against the United Verde Copper Co. A former decree in favor of the plaintiff had been set aside by the court to allow additional testimony for the defendant. Judge Morris, however, held that the use of patent process for converting copper was an infringement on the patent rights of the Peirce-Smith company.

Idaho-Maryland Will Increase Output at Grass Valley

At the Idaho-Maryland mine, at Grass Valley, Calif., the main shaft has been extended to the 2,000 level and a new hoist has been installed. The headframe and surface structures have been strengthened to permit of more rapid hoisting. An ore-pocket is being constructed at the 2,000 level. The improvements will be completed by May 15, at which time the 20-stamp mill now operating two shifts per day will be placed on three-shift operation.

Development is proceeding at the rate of 1,000 ft. per month. A deep-hole drilling outfit has been purchased, and horizontal holes are being driven into the foot and hanging walls from 50 to 250 ft. in depth. An aggregate footage of 500 ft. has been drilled at a cost of $1 per ft. for labor and 30c. per ft. for supplies. The drill is being used in prospecting for parallel leads.

Nevada Rand Ships High-Grade Gold-Silver Ore

Two recent shipments of high-grade ore from the Nevada Rand mine, in Mineral County, Nev., show the following results on settlement by Western Ore Purchasing Co.: Seventeen tons running 4.22 oz. gold and 169.50 oz. silver; 18 tons running 2.99 oz. gold and 116.80 oz. silver. Total smelter returns amounted to $4,301.

W. V. Rudderow, manager, says that the ore is being extracted from development work on the east 250 level, where a vein 4 ft. in width is also producing milling ore that is being placed on the dump. Samples of fifty tons of the milling grade averaged $39.47 per ton.

A new ore bin is now being erected to make possible the shipment of lower-grade ores. The ore is highly oxidized at the 250 level, and consists mainly of cerargyrite and gold in a gangue of quartz, calcite, and manganese oxides. The orebody on the 250 level is about 70 ft. ahead of the drift now being driven to cut it on the 450 level.

Cassiar Crown Reorganized

The Cassiar Crown Mining Co., has been reorganized, and a new company formed in Spokane to be known as the Cassiar Crown Copper Co., and the capitalization changed from 1,500,000 $1 shares to 2,500,000 shares of a par value of 5c.

United Comstock Mines Co. Earned $64,285 in First Quarter

DURING the first three months of 1924, the operations of the United Comstock Mines Co. resulted in a profit of $64,285.80. The ore mined and treated totaled 123,097 tons, yielding $508,916.20, which, with other income amounting to $2,490.50, gave a total income of $511,406.70. Expenditures were as follows:

Mining and development..	$220,562.73
Milling	192,464.89
Administration	8,499.99
Taxes	9,000.00
Royalty	10,178.32
General	6,414.97
Total expenses	$447,120.90

This makes the total operating cost $3.63 per ton. The net operating profit for the quarter was $64,285.80.

During 1923 a total operating deficit of about $400,000 was recorded. A change of administration whereby R. H. Channing became managing director took place late in the year, and results improved.

El Paso Mine, at Cripple Creek, Will Be Reopened

The El Paso mine, on Beacon Hill, at Cripple Creek, Colo., one of the former well-known and heavy producers, will again be operated. A corporation called the Allen L. Burris Mining & Development Co. has been organized for the purpose.

For the last six months Kenneth McDermid, of the Mary McKinney, has been operating the shaft equipment, and has been driving a lateral into Guyot Hill to reach his property. This work will continue, and the new company will for the present confine operations to development work on the ninth or bottom level of the El Paso.

Prospects for ore on the lower levels are said to be excellent, with good indication in veins which were big producers nearer the surface.

Plan Development of Drift Mining Property Near Downieville

W. P. Hume, of San Francisco, has contracted with W. J. Belcher and Mark N. Alling for the purchase of drift mining property near Downieville, Calif., involving a tract about three miles long, extending from the southern bank of the north branch of the Yuba River to the northern bank of Oregon Creek. The tract is believed to contain the extension of the channel worked in the Monte Cristo drift mine, one of the early day producers. The purchase price is stated to be $600,000, payable over a period of years as the property is developed. The annual expenditure for development and mining is to be $25,000 or more.

The present plan is to determine by drilling the extent of the channel, which has been tapped by an exploratory shaft. A company is to be incorporated, by Hume and his associates.

London Letter

By W. A. Doman
Special Correspondent

Waihi Grand Junction Will Suspend Operations

H. Stansfield's Resignation Not Explained—Mysterious Cable Dispatch Still a Secret

London, April 22—For five or six years the Waihi Grand Junction Gold Co. (New Zealand) has been out of the dividend list, and substantial deficits have accumulated. As a result and following upon the resignation of the consulting engineer, H. Stansfield, to which I referred at the time, the directors requested R. E. Williams, consulting mining engineer, of Auckland, N. Z., to make a complete investigation, and his report has recently come to hand.

The real cause of Mr. Stansfield's resignation has not been made known. It was evidently due to a misunderstanding with the directors, as they—at one of the general meetings—quoted a telegram from the mine, sent by H. Stansfield, to the effect that he considered the mine "in a condition to give a constant supply of ore and ensuring fair profits for years." This has been emphatically denied. Whoever was responsible for the sending of the cable dispatch in question was apparently incorrectly informed, for in accordance with Mr. Williams' advice, the directors have taken immediate steps to suspend crushing operations and the mill will soon be shut down. Mr. Williams' report has not been published, but it is evident that he recommends a development program, and when this is further explained to the board, the shareholders will be fully informed of the position.

Selukwe Report Not Pleasant

The annual report of the Selukwe Gold Mining & Finance Co., which deals with properties in Rhodesia, in Canada, and in Burma, does not make such good reading as shareholders had expected. There are, however, good points, and it is from the speculative aspect that shares are being supported. In regard to Northern Rhodesia, the company has provisionally acquired a 20 per cent interest in three groups of mining claims showing indications of copper content. On one of these areas the copper-bearing formation outcrops over a length of 2,000 ft.. with a width of 4 or 5 ft.. and it is said that samples have yielded high copper content, with some gold values.

The particular item of interest is the Shan Estates Silver Lead Corporation (Burma) with an authorized capital of 300,000 shares of 5 rupees each. Development has not been extensive, but in parts the engineer states that the faces of the drives afford optimistic expectations. The Selukwe company was offered an option on the property in consideration of registering a company in Burma and subscribing £20 000 for working capital to operate and finance the property. As further consideration it is entitled to acquire a 58 per cent interest in the business.

As I have pointed out on previous occasions, mines on the Rand die hard. Only recently the Simmer & Jack acquired claims from the old and abandoned Simmer Deep; now it is announced that the Geldenhuis Deep has acquired approximately twenty claims that belonged to the old Jupiter, a property which, owing to its low grade, high working costs, and falling off in the gold premium, has been shut down for about three years. Whether in this instance, as was reported in the case of the Simmer Deep, all the mine timbers have been extracted, has not been made public, but as the cost price is only £1,200 the Geldenhuis Deep will be certain to get its money's worth.

Renison Bell Tin Mine May Be Reorganized

The Renison Bell Tin Mine, some nine miles from Zeehan, on the west coast of Tasmania, has been worked off and on during the last thirty years. Most of the oxidized ore has been extracted and the future of the property depends on the successful treatment of the pyritic deposits. J. B. Lewis, consulting engineer, states that there are "large bodies running probably into hundreds of thousands of tons assaying from 0.75 to 6 per cent."

The original company started crushing in 1909, with a five-head mill, and from 1909 to 1916 crushed 98,153 tons for 474 tons of metallic tin. At the outbreak of war a ten-head battery was at work and an additional ten-head battery was installed together with a calcining plant. The company, however, got into financial difficulties, and the mine fell into the hands of the mortgagee, who has worked it on a limited scale. It is now proposed to form a new company with a capital of £40,000, which it is claimed is the value of the plant and equipment, and the aim of the promoters is not only to recover the tin but to produce ferric oxide and ferrous sulphate, for which a good market exists. On the basis of 30,000 tons of 0.75 tin oxide, the prospectus estimates a profit of £44,255.

Seek Phosphate to Utilize Pyrrhotite Tailing at Kimberley, B. C.

With a view to utilizing some of the immense quantity of pyrrhotite tailing that is going to waste at its Sullivan concentrator, at Kimberley, B. C., the Consolidated Mining & Smelting Co. has published a pamphlet, giving field tests for and the general appearance of phosphate rock deposits and has offered to make free determinations of phosphoric acid content of samples sent to the laboratory, at Trail, by prospectors from any part of British Columbia.

The Sullivan mill is now treating 3,000 tons of ore per day, between 60 and 70 per cent of which is pyrrhotite, which is the principal component of the mill tailing. There is a considerable demand for phosphate fertilizer in the Canadian West, and if a large deposit of phosphate rock could be found the company would use a part of the tailing for the manufacture of sulphuric acid for making superphosphates.

Johannesburg Letter

By John Watson
Special Correspondent

Bwana M'Kubwa Will Have 500-Ton Treatment Plant

Process Will Produce Refined Copper—Excellent Recovery Indicated—New Concession on 1,800 Square Miles

Johannesburg, March 31—At the Bwana M'Kubwa mine in northern Rhodesia, the treatment process being tried by the Mineral Separations, Ltd., of London, has proved capable of recovering 90 per cent of the average content of the copper ore and of giving refined copper of 99.6 per cent purity, on the spot. Designs are in hand for a plant to treat 500 tons of ore daily, to be delivered and erected within about twelve months.

The Bwana company has purchased the interests of the C. V., Ltd., in the M'Kana mine about thirty miles away. This purchase includes the prospecting concession over 1,800 square miles of cupriferous country.

The Gold Producers' Committee of the Chamber of Mines has fixed the bonus to workers for the month of March at 6 per cent. The distribution will amount to about £30,000. The total amount distributed as bonus by the industry for the first quarter of this year will amount to about £85,000. The production of cassiterite (tinstone) in the Union for the last ten years has been as follows:

Year	Short Tons	Value
1914	3,429	£311,391
1915	3,441	331,420
1916	3,264	339,571
1917	2,678	346,016
1918	2,206	440,995
1919	1,630	277,925
1920	2,463	435,680
1921	1,424	139,688
1922	612	59,986
1923	1,424	174,147

About ten days ago, a diamond of 7½ carats was found in the crop of a dead bird on the farm Klippan, No. 46, in the Lichtenburg district. The diamond has been deposited with the local magistrate.

A provisional agreement has been drawn up by which the Randfontein Estates company will absorb the Randfontein Central. Shareholders in the latter company will receive three new shares fully paid in the Estates company for every five Central shares held by them. Special meetings are to be held in June to wind up the Randfontein Central and confirm the agreement. The Estates company will increase its capital to a sufficient extent to provide the new shares required and will surrender and agree to concellation of its holding in the Randfontein Central shares and debentures.

Natomas Company Will Rebuild Gold Dredge

Gold dredge No. 10, of the Natomas Company of California, is to be dismantled and will be reconstructed on a subdivision of the G. K. Ney estate in the Ney district. The pit for the dredge is now being constructed, and it is expected to have the machine in operation early in 1925.

Situation at the Mines

By Arthur B. Parsons
Assistant Editor

CURRENT income and therefore the prosperity of most mining companies (gold, of course, excepted) hinging largely on the prevailing prices for metals, no great discernment is necessary to describe the situation as less satisfactory than it was a month ago. Copper at 13.05c. is off ⅛c.; zinc at 5.9c. is down ¼c.; and lead, the mainstay of the industry during recent months, has experienced a decline of a little over one cent, being quoted at 7.95c. Moreover, the early shipments of iron ore from Lake Superior have been made at a cut of 80c. per ton from last year's prices.

Lead Mining Continues to Thrive

As for lead, the price is entirely satisfactory and no apprehension is felt at the mines. Production is maintained at near capacity, the most significant recent change being the starting of an additional furnace at the Bunker Hill smelter in the Coeur d'Alene district. This is in consequence of the accumulation of concentrate following resumption at full capacity by the Hecla Mining Co. Lead mining in the Stevens County, Washington, and other northwest districts, tributary to both the Bunker Hill and Trail smelters, is more active than for several years. A new, if small, contributor to the lead output is the Eureka-Holly at Eureka, Nev., which has just started its 100-ton flotation concentrator. Shipments go to Utah.

The Ahumada mine, in Chihuahua, Mexico, at which production was temporarily curtailed on account of a fire, is again shipping regularly to the El Paso smelter.

The two smelters in Colorado are supplied with all the ore they can handle and southeast Missouri operations are at maximum. Nine cent lead probably would induce the shipment of some ore that will stay in the mines at 8c., but producers generally are satisfied and prosperous.

Incomplete figures and estimates indicate that the aggregate rate of copper output is less than on April 1, which means considerably less than the maximum of the last six months. All of the Michigan mines have curtailed somewhat, and the shutting down of the Seneca and Gratiot mines because of financial difficulties has cut 550,000 lb. from the total.

The tendency throughout Arizona is to taper production, Miami and Calumet & Arizona, as well as Inspiration and Phelps Dodge, being among those where decline is noticed. Five active properties in California are producing about 4,200,000 lb. monthly, nearly double the rate of last November, but California is not an important producer. Hopeful is about the most optimistic adjective that can be used to describe copper mining at the moment.

Zinc Production Exceeds Current Sales

Zinc stocks are accumulating in the Joplin-Miami district, where the current output of 14,000 tons of "jack" (60 per cent concentrate) weekly exceeds sales by from 1,500 to 2,000 tons. Discontinuance of night shifts at some properties and a few shutdowns have reduced output somewhat, but concerted action to curtail would not surprise onlookers. Butte & Superior is pushing zinc ore production in Montana, and mines in the Coeur d'Alene district are shipping about 200 tons of high-grade ore and concentrate daily to the electrolytic plant at Great Falls.

The large slice taken from last year's iron-ore scale is not reassuring. Buying for 1924 delivery has not been large to date, and independent producers in the Lake Superior region are not anticipating as active operations as prevailed last year. The announcement of the new prices was followed by the shutting down of two mines, and still others will probably suspend.

Ordinarily the coming of spring is accompanied by a stringency in the supply of labor available at the larger producing mines, owing to the exodus of mine workers to farms, lumber camps, construction projects, and other outdoor work, as well as to the outlying districts where prospecting and mine development is most active in the good weather. The movement is taking place as usual, but the stringency is not felt. This exactly dovetails with, and is explained by, the tendency to curtail output of copper, zinc, and iron. At the same time, there is no surplus of men, and as the summer advances a shortage may develop.

Gold and silver mining surely is picking up. Symptomatic of this are: Increased output from Tonopah, Nev., where about 400,000 oz. of silver monthly is being produced; decision by the Plymouth Consolidated at Plymouth, Calif., to sink 900 ft. deeper; gradual reduction of costs by the United Comstock Mines, which in the first quarter of 1924, made an operating profit of $64,000, against a loss of about $400,000 during 1923; reopening and profitable operation of the Chichagof gold mine, in Alaska; construction of a large new gold dredge by the Kafue Copper Development Co., at Antler Creek, in British Columbia; increasing of its dividend rate from 2c. to 3c. by the Golden Cycle company, controlling Cripple Creek mines; planning of important improvements at the North Star mine, at Grass Valley, Calif., and increasing activity in Canadian gold and silver districts.

In California four quicksilver mines are producing, the industry being stimulated by a market around $78 per flask. California-Rand, the principal silver producer, is still milling on a curtailed basis pending the catching up of development work. No labor shortage is felt nor expected, although experienced miners are not overabundant.

Old Treasure Hill Mines To Be Reopened

Hamilton, the old bonanza Nevada silver-lead camp, is being revived by the Tonopah Mining Co. which has taken over property on Treasure Hill. Other companies are entering the same territory. A significant step is the installation of a 2,000-hp. Deisel engine unit by the Tonopah Extension Mining Co. to obviate the irregularity of the present source of hydro-electric power.

In Washington development operations are unusually active. Besides the lead districts of Stevens County, the Republic gold camp is busy. Deep exploration by the Surprise Mining Co. has started; and a plan to merge several properties and to erect a plant for treating low-grade ore is causing some commotion.

A satisfactory labor situation is reported in the Coeur d'Alene district in Idaho. The lead output is at the rate of 48,000,000 lb. per month. The Bunker Hill interests have optioned and will develop a gold property in Central Idaho.

Wages have been raised 25c. a day by Utah Copper Co. at its Bingham mines and Garfield mills, by the other mining companies at Bingham, and by all of the Utah smelting companies. A brief strike at the Midvale smelter called with the hope of getting a 50c. increase ended with a 25c. compromise. Bingham miners now get $5.00, still 25c. per day behind Park City and Eureka. No shortage of miners is felt.

At Butte the Crystal Copper Co. has extended its holdings and will increase development; and the Tuolumne Copper Co. plans to sink its Main Range shaft to 2,800 ft. Anaconda is marking time on its curtailed basis of copper production. Miners are available in ample numbers.

Plenty of men, but a slight scarcity of real miners, is the situation in Colorado. One hundred men have been laid off at the Black Bear, at Telluride, shut down on account of legal troubles.

Unionization of miners in the Joplin-Miami zinc-lead district, operators admit, is progressing. Heretofore such movements have always been successfully forestalled. No demands for higher wages have yet been made.

New Mills Projected in Northern Ontario

Northern Ontario is as active as ever with respect both to development and production. At South Lorrain the Mining Corporation has just removed a chunk of vein matter weighing two tons and assaying 12,500 oz. silver per ton; this indicates the character of the deposit. The Teck-Hughes company is to sink a new shaft and enlarge the capacity of its mill at Kirkland. In the Porcupine district developments are so good that the West Dome mill is likely to be restarted; and the early construction of a plant by the Crown Reserve at Larder Lake is anticipated.

The Consolidated M. & S. Co. has started a shipment of six cars of zinc concentrates from its Sullivan concentrator in British Columbia to Antwerp via the Panama Canal. Britannia and Granby are producing copper at maximum capacity.

Men You Should Know About

J. B. Reeside is engaged in field work in the Powder River Basin of Wyoming.

Charles A. Liddell has returned to Tonopah from a professional trip into central California.

W. H. Wiley is in Tonopah on professional business for the West End Consolidated Mining Co.

S. H. Brady has succeeded **Roy K. Brown** as superintendent for the Rescue Eula Mining Co. at Tonopah.

E. A. Julian, general manager of the Goldfield Consolidated Mining Co., has returned to San Francisco from Reno.

R. U. Jarvis has recently returned from Siberia and passed through New York last week on his way to Alaska.

David White has been elected chairman of the Division of Geology and Geography of the National Research Council.

Harry Kee, mining engineer, is in charge of operations at the Wattlaufer mine, South Lorrain, where work is being resumed.

L. R. Robins, superintendent of the Tonopah Belmont Development Co. at Tonopah, has gone to Philadelphia on company business.

Professor Theodore Simons, of the Montana State School of Mines, has been elected president of the Montana Society of Engineers.

A. H. Holbrook, the dean of the School of Mines at Penn State College, is in Washington conferring with Bureau of Mines officials.

Dr. J. W. Evans, lecturer in petrology at the Imperial College of Science and Technology, London, is the new president of the Geological Society of London.

Kenneth C. Heald has been appointed associate professor of geology at Yale. He was formerly an official of the gas and oil section of the U. S. Geological Survey.

John G. Barry is severing his business connection with the American Smelting & Refining Co., at El Paso, Tex., and will visit the East about the first of June.

Dorsey A. Lyon, assistant director of the Bureau of Mines, is inspecting the work at the Bartlesville, Minneapolis, and Columbus experiment stations of the Bureau.

H. Foster Bain, the director of the Bureau of Mines, and **T. T. Read**, of the Bureau's technical staff, made a personal inspection of the Benwood mine following the disaster.

E. F. Burchard, of the U. S. Geological Survey, is in Alabama to bring up to date geologic information revealed by drilling and mining developments in the iron-ore district.

Charles Spearman, mining geologist and engineer, of Montreal, will soon make an extended trip of examination in the new Quebec gold fields of Rouyn and east into Fournier and Dubuisson.

J. W. Morrison, who was formerly in charge of operations at the Lake Shore mine, has been given direction of the work at the Canadian-Kirkland, which is being dewatered in preparation for development.

Edward Thornton, vice-president of the Southwestern Engineering Corporation, is making an extended trip through the northwest, and expects to return from Wyoming to Los Angeles early in May.

Maurice W. Summerhayes, manager of the Crown Reserve, has concluded an examination of the Barry-Hollinger mine, in the Boston Creek area of northern Ontario, of which he is consulting engineer.

J. Mackintosh Bell

J. Mackintosh Bell recently returned from a visit to England and is now in northern Ontario investigating conditions at the Vipond, Keeley and Canadian Lorrain mines, with regard to the advisability of deeper mining.

Ralph Arnold, of Los Angeles, was injured in an automobile accident on April 23, near Modesto, Calif., and suffered a fracture of the hip bone. Mrs. Arnold, who was also in the car, escaped without hurt.

Charles C. McGinnis has arrived in Salt Lake City from Choix, in Sinaloa, Mexico, where, together with Salt Lake mining people, he is working some mining properties and expects to put in a twenty-five-ton amalgamating and concentrating plant.

James F. McCarthy, of Wallace, Idaho, president and general manager of the Hecla Mining Co., has gone to Alaska to investigate mining property in a section tributary to the Government Railroad. He is expected to return about May 10.

Gerald C. Collingwood, of London, England, representing a number of English investors, is making an inspection of northern Ontario mining properties, accompanied by two engineers. He recently made investigations in the country traversed by the Algoma Central Ry.

C. A. Young, of Houston, Tex., formerly with the Lucey Manufacturing Co., will take charge of the standardization work of the American Petroleum Institute as outlined at its St. Louis meeting. Mr. Young will for the present make his headquarters in Houston.

W. Earl Greenough, of Wallace, Idaho, is in New York on business in connection with the recently organized Atlas Mining Co., which has acquired the Idaho Carbonate Hill group of claims in the Coeur d'Alene district and which will soon undertake an extensive development program under Mr. Greenough's direction.

Frank Hodges, formerly a miner and now First Civil Lord of the British Admiralty in the Labor government, has introduced a bill in Parliament having for its object abatement of the smoke nuisance. A party of eight English engineers is now in the United States making a survey of conditions here.

A. Sauveur, professor of metallurgy and metallography at Harvard University, has been awarded the Bessemer gold medal for 1924 by the Iron & Steel Institute. Dr. Sauveur was formerly the editor of *The Metallographist* and the *Iron & Steel Magazine*. He was appointed metallurgical expert to the French Ministry of Munitions in 1917.

William Kelly, president, and **F. F. Sharpless**, secretary, of the American Institute of Mining and Metallurgical Engineers, are visiting the copper camps of the Arizona district. **I. H. Barkdoll**, secretary of the Arizona section, announced that all members of the Globe-Miami district would be guests of the Institute at a banquet given at Globe on May 3 in honor of the visiting officers.

R. D. Bush, California state oil and gas supervisor, announces several changes in his department as follows: **V. H. Wilhelm** has been appointed deputy supervisor for district No. 5, with headquarters at Coalinga, to fill the position vacated by the resignation of Former Deputy Supervisor **R. M. Barnes. E. Huguenin** has been appointed deputy supervisor for district No. 4, with headquarters at Taft, to fill the vacancy caused by the resignation of **W. W. Copp. H. A. Godde** formerly petroleum engineer in the department of petroleum and gas, has been appointed deputy supervisor for district No. 2, with headquarters at Santa Paula, to succeed Deputy Supervisor **Huguenin.**

Frederick G. Clapp is making extensive studies in the Kimberley desert region of Western Australia, after ruling out the greater part of eastern Australia as unpromising for oil in commercial quantity. The Kimberley desert is situated mainly between the Tropic of Capricorn and the nineteenth parallel of latitude and is intermediate between the Pilbarra and Kimberley gold fields. The desert is of Carboniferous or Permo-Carboniferous age on which rocks and immense sand hills are superposed, and consequently the region has been seldom crossed. The present expedition, headed by Mr. Clapp, is entering by means of motor tractors similar to those which successfully crossed the Sahara. As the rocks are of suitable age and oil showings have been reported by former explorers, hopes are entertained that a promising field may be found.

Societies, Addresses, and Reports

American Zinc Institute at St. Louis Meeting Elects A. E. Bendelari President

Economic Considerations Formed Principal Topic of Discussion at Two-day Session—Advertising Campaign to Continue

A. E. BENDELARI, of Joplin, Mo., vice-president of the Eagle-Picher Lead Co., was elected to head the American Zinc Institute, at the annual meeting, held at the Chase Hotel, St. Louis, on April 28 and 29. Mr. Bendelari, who succeeds F. C. Wallower, also of Joplin, vice-president of the Golden Rod Mining & Smelting Co., is a popular choice, not only with the mining men of his own district but with the smelting and rolling mill members.

The meeting of the Institute was well attended, and the program of addresses and papers embraced almost every problem of importance that the zinc industry is seeking to solve. What was considered a matter of primary interest was the publicity committee's report on the proposal of a year ago to raise a fund of $100,000 to advertise zinc. Only a small part of this fund had been raised, and ways and means were discussed for improving the method of attempting to raise it. It is believed the money will be forthcoming this year. Representatives of mining, smelting, and rolling mill interests alike indorsed the program.

Jesse G. Starr, of Joplin, president of the Quinton Spelter Co.; John A. MacCarthy, New York, of the Anaconda Copper Mining Co.; and A. P. Cobb, New York, of the New Jersey Zinc Co., were made vice-presidents. Directors chosen include MacCarthy, Starr, Charles W. Baker, William A. Ogg, Henry S. Wardner, and Julius Hegeler.

Following registration of the members Monday morning, President Wallower opened the session with a brief address, following which there was an address of welcome by Mayor Henry W. Kiel of St. Louis, and a response by Sidney H. Davis, president of the Tri-State branch of the Institute.

James F. Callbreath, secretary of the American Mining Congress, told of the effort being made for the retention and improving of the depletion clause in the tax measure now before Congress and asked for support of the Zinc Institute membership.

At the afternoon session, C. Y. Semple, a mine operator and building man of Baxter Springs, Kan., told of his experiences in marketing sheet and shingle zinc roofs. He declared it to be pioneering in business, but said good results followed where advertising was persistent and followed up by intelligent efforts in salesmanship.

E. V. Peters, sales manager of the New Jersey Zinc Co., discussed "The American Zinc Institute," explaining the reason for its existence and why this existence is well justified. He pleaded for more complete co-operation between the different factors in the industry, to the end that the Institute will be better able to serve both the public and itself.

Roy De Staebler, of the Beck & Corbitt Iron Co., of St. Louis, talked of galvanized sheets, and declared that men in the zinc industry are themselves to blame for not having a bigger demand for galvanizing and for a higher grade of galvanizing. He pointed out that some galvanizing at present runs only one ounce to the square foot of zinc, which is entirely too thin.

In making the report of the publicity committee, Edward S. Gellattly proposed that the sum sought for advertising purposes should be $200,000 instead of $100,000, and pointed out that with such a fund the demand for zinc would be increased unquestionably by 400,000 tons per year. The report was referred to the board of directors and brought back for further discussion and for adoption at the $100,000 figure in place of the committee's suggestion.

Edward J. White, vice-president of the Missouri Pacific Railroad, and W. K. Kavanaugh, president of the Southern Coal, Coke & Mining Co., were the principal speakers at the annual dinner, held Monday night, with Captain Dan Dwyer, of Joplin, who gave reminiscenses of his early mining experiences. President Wallower presided as toastmaster and dancing followed the dinner.

At Tuesday morning's session W. J. Nolle, of the *Daily Metal Trade*, of Cleveland, pointed out how the price of slab zinc in America follows the fluctuations of the market in London, and said that changes in both markets are presaged by building activity.

James H. Wadleigh, mining editor of the *Joplin Globe*, discussed zinc mining as a business, arguing that mining men have not, except at widely separated intervals, realized a just return on the capital invested. The reason for this he attributed to the method of selling zinc ore, basing prices on the prevailing price of slab zinc. He blamed the producer of zinc ore for placidly accepting such an arrangement, but declared that the smelterman should appreciate that it is to his interest to see to it that the ore producer is enabled to carry on at a fair profit.

H. A. C. Jennison read a paper on the economical utilization of national resources.

In the afternoon the session was brought to a close by the installation of the newly elected president, and by a cross-section program by the U. S. Bureau of Mines, at which George C. Stone presided. Talks were made by Dorsey A. Lyon, W. H. Coghill, B. M. O'Harra, C. E. Van Barneveld, and Arthur Thacher, and a paper was read, written by C. E. Siebenthal, on "Keeping Zinc Books for the Government."

It was voted to hold next year's meeting at St. Louis.

Refractories and Electrodeposition Discussed by Electrochemists

Many papers of interest to metallurgists were read and discussed at the forty-fifth meeting of the American Electrochemical Society at Philadelphia on April 24, 25, and 26; of particular importance was the discussion on refractories for electric furnaces and on electrodeposition. Howard C. Parmelee, editor of *Chemical and Metallurgical Engineering*, was elected president.

At the round-table discussion on refractories, Dr. Alfred Stansfield, of McGill University, was guest of honor and first speaker. Where the temperature was too intense for a roof made of silica brick, he suggested making the roof thin and either air- or water-cooling it.

Water-cooled magnesite linings are now regular practice in many foundries. Neutral linings of sillimanite are now being used in some places instead of silica or magnesite. Dr. Otto Frick described the induction furnace which has been given his name and told of its success in Germany.

H. Y. Eagle presented a short paper on "Electrodeposition of Copper at the Union Minière du Haut Katanga," describing the new electrolytic tank house and its operation. The tanks are 55 ft. 7 in. long, 3 ft. 2½ in. wide, and of an average depth of 4 ft. 3 in., being the largest of the kind ever built. They are of reinforced concrete, lined with 2 in. of asphalt mastic, with the electrodes placed transverse of the tank length. High acidity and uniform composition throughout the tanks is a feature of the electrolyte, which contains 60 grams of free sulphuric acid per liter, and circulates at the rate of 20 liters per minute through the cathode tanks after first passing through a starting-sheet tank. The temperature is about 37 deg. C., and as total iron is never allowed to go over 6.5 grams per liter, little harmful effect on ampere efficiencies has been experienced. Insoluble lead anodes are used and the energy efficiency during the complete test period mounted to 1.12 lb. of copper deposited per kilowatt-hour. The cathode current density was 9.13 amperes per square foot, and the ampere efficiency 83.33 per cent. A difficulty in stripping starting sheets from hard-rolled copper blanks was solved by amalgamating the sheets.

Other interesting papers, about which more will be said in future issues, included: "Electrolytic Refining of Tin," by J. R. Stack; "Progress in Electrolytic Iron," by Donald Belcher; "Addition Agents in Tin Refining Electrolytes," by Edward F. Kern and Edward A. Capillon; "Mechanically Perfect Electrolytic Nickel," by Charles P. Madsen; "The Electrolytic Tank House, Chile Exploration Company, Chuquicamata, Chile," by C. W. Eichrodt; "The Metallurgy and Alloys of Beryllium," by E. A. Engle and B. S. Hopkins; "The Electrolytic Production of Beryllium," by B. S. Hopkins and A. W. Meyer; and "Electrolytic Tin," by Charles L. Mantell. All of these papers have been published by the American Electrochemical Society, Columbia University, New York City, and written discussion is invited.

Recent Technical Publications

Reviews, Abstracts, and References

The Lightest Common Metal

Magnesium. A handbook published by the American Magnesium Corporation, Niagara Falls, N. Y. Pp. 177. Price $2.50.

There is no other volume just like this one—that is, no book published by a metal manufacturer describing in great detail the chemical and physical properties of his product, the alloys that can be made from it, with their characteristics; the behavior of the metal under certain conditions of working and handling together with the commercial forms in which the metal can be obtained. This is precisely the field covered by this little book on magnesium. It has collected and digested under one cover the fruit of years of research by investigators all over the world in the properties and application of the lightest metal in commercial use today. Considering the fact that the literature on this subject has not been very profuse, the reference list given at the end of the book is valuable to anyone working with the metal and wishing to consult original sources. The book is illustrated by many handsome halftones and line cuts. It is attractively printed and presented and is so far ahead of the ordinary type of catalog or trade literature that it deserves to be elevated from this class of printed matter and placed in the textbook category. The unnamed author and the publishers deserve credit for the effort they have put into this work and the frankness in which they have published the results of their own experimentation.

F. E. WORMSER.

Non-metallic Minerals—"New Uses of Non-metallic Minerals" are described in U. S. Bureau of Mines *Reports of Investigations*, Serial No. 2,587, 7 pages, obtainable on request to the Bureau at Washington, D. C. Reference is made to andalusite, cyanite, sillimanite, beryl, spinel, and bentonite. The bulletin is by W. M. Myers.

Cobalt—The Imperial Institute has published a 54-page book on "Cobalt Ores"; price 3s. 6d., from John Murray, 50a Albermarle St., London, W. 1, England. Occurrences and commercial utilization of cobalt ores throughout the world are covered, and a bibliography of seventy references is appended.

Liquid Oxygen—Alan G. Wikoff, in the Feb. 4 issue of *Chemical & Metallurgical Engineering* (475 10th Ave., New York City; price 25c.) has a 4-page article on an economical plant for producing "Oxygen by the Liquefaction Process." The Oxeco liquefaction process is described, it being adapted to the manufacture of liquid oxygen in individual plants as required in the field.

Oil Shale—U. S. Bureau of Mines *Reports of Investigations*, Serial No. 2,588, 10 pages, is entitled "Fractional 'Eduction' of Oil From Oil Shale." It is by Martin J. Gavin and Lewis C. Karrick, and may be obtained from the Bureau on request.

New York Metal Industry—An organization known as the Regional Plan of New York and Its Environs, 130 E. 22d St., New York City, has published a monograph on the metal industry in and about the city, by Prof. V. W. Lanfear, of the Department of Economics, Yale University. Trends in the industry are discussed, with particular reference to the utilization of land areas to the best advantage. The paper, which is of 50 pages, may be obtained for $1.

The Evolution and Disintegration of Matter—The U. S. Geological Survey, Washington, D. C., has published Professional Paper 132-D, 35 pages, under this title. It is by F. W. Clarke and is a most interesting scientific discussion, in terms that can be understood by any one with scientific training, of how the earth was formed, what is happening to it now, and the part played by the various chemical elements. Copies may be obtained on request from the Survey as long as the supply lasts and thereafter for 10c. from the Superintendent of Documents, Washington, D. C. This is a paper that deserves wide distribution. Mr. Clarke is also the author of "The Data of Geochemistry," another interesting book.

Petroleum—"The Distribution of Sulphur in Crude Petroleum" is the title of a 17-page paper by N. A. C. Smith and D. D. Stark, issued by the U. S. Bureau of Mines, Washington, D. C., for free distribution, as *Reports of Investigations*, Serial No. 2,582. This is a study of the distribution of sulphur in the various products obtained from light Mexican crude.

Standardization—The April issue of *The Mining Congress Journal* (Washington, D. C.; price 30c.) is largely devoted to the subject of standardization as applied to metal mining, mine drainage, drilling and blasting, tracks for open-pit mines, locomotive cranes, electric and steam shovels, drilling machines and drill steel, and outside coal-handling equipment.

British Columbia Map—D. B. Morkill has prepared a map (17x30 in.; scale 1 in. = 1 mile) of the country about the Salmon River north of Stewart, B. C., showing all claims in this section of the Portland Canal Mining Division. Obtainable for $1 from the Vancouver Map & Blueprint Co., 441 Seymour St., Vancouver, B. C.

Limestone Mining—Oliver Bowles describes the exploitation of limestone deposits by underground mining in U. S. Bureau of Mines *Reports of Investigations*, Serial No. 2,585, 9 pages, obtainable on request to the Bureau. A general discussion is followed by nine examples of limestone mines.

Boiler Tests—The Combustion Engineering Co., 43 Broad St., New York City, will send a copy of C. W. E. Clarke's paper entitled "Boiler Tests With Preheated Air" to any one desiring it. This paper was presented at the annual meeting of the A. S. M. E. in New York in December, 1923.

Mineral Statistics—Recent bulletins of the Imperial Mineral Resources Bureau covering world production, imports and exports, and related data for the years 1919-1921, include: "Platinum and Allied Metals," price 1s. 3d.; "Felspar," 6½d.; "Sulphur," 1s. 6½d.; "Manganese," 1s. 6½d.; "Borates," 1s. 3½d.; "Nitrates," 2s. 1d.; and "Fuller's Earth," 6½d. These are obtainable at the prices mentioned, from H. M. Stationery Office, Imperial House, Kingsway, London, W. C. 2, England.

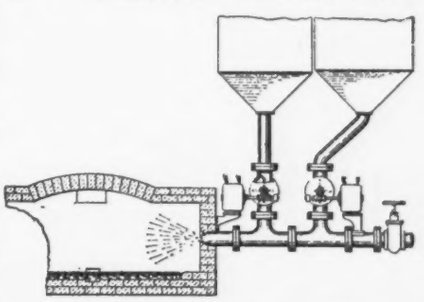
Mine Ventilation—Serial No. 2,584, U. S. Bureau of Mines *Reports of Investigations*, 13 pages, is entitled "Some Effects on Man of High Temperatures." It is by W. J. McConnell and R. R. Sayers, and gives results of laboratory work carried on at the Pittsburgh experiment station, using air above 90 deg. F. The bulletin may be obtained from the Bureau on request.

Economic Geology—*Economic Geology* for January-February (Lancaster, Pa.; price 65c.) contains the following major articles: "Determination of Ore-minerals by X-ray Diffraction Patterns," by Paul F. Kerr, 34 pages; "Experiments on Capillarity and Oil Migration," by William L. Russell, 27 pages; "Notes on Ground Waters," by G. F. Loughlin, 10 pages; and "Possible Potash Production from Minnesota Shale," by Harrison Schmitt, 12 pages.

Patents

Flotation—No. 1,488,745. April 1, 1924. Risdale Ellis, Oak Park, Ill., assignor to Ellis Flotation Co., Inc., New York. A flotation process for minerals in which a readily condensible gas comprising the anhydride of an oxy-acid is introduced into the ore pulp.

Ore Smelting—No. 1,490,012. April 8, 1924. Albert Kapteyn, Jr., Brooklyn, N. Y. Finely ground ore and carbonaceous fuel are mixed together just prior to blowing into a reverberatory furnace as shown in the accompanying illustration.



Titanium Extraction—No. 1,489,183. April 1, 1924. Charles Weizmann and Joseph Blumenfeld, London, England. Titanium compounds are extracted from ores of that metal by treating the ore with 70 to 90 per cent sulphuric acid at about 150 to 180 deg. C.; cooling and extracting with water, limited in amount so as to leave most of the iron sulphate undissolved; then separating titanyl sulphate in concentrated solution from the undissolved residue. Only about four parts of water are used per part of titanium oxide in the acid-treated ore.

New Machinery and Inventions

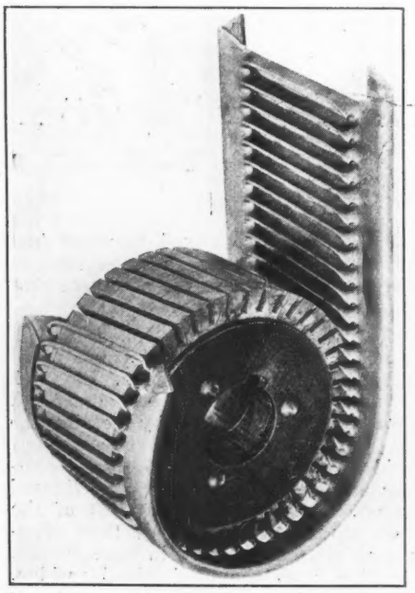
A New Heavy-Duty Motor of Unusual Construction

A new heavy-duty motor has come on the market, the design of which is rather unusual. It is shown in the accompanying cuts. It is of the polyphase squirrel-cage type, and carries a full rated load continuously, with a temperature rise not exceeding 40 deg. C. above the surrounding air, and, after the ultimate temperature has been reached, carries 25 per cent overload for two hours with a temperature rise not exceeding 55 deg. The motor is capable of starting with abnormally heavy loads.

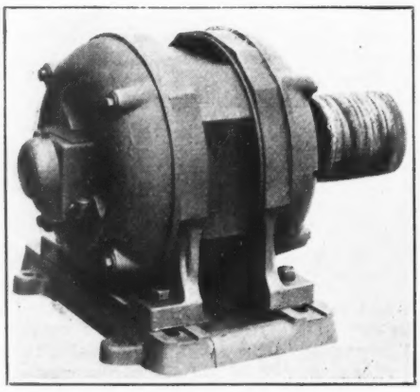
The end frames, including the surfaces of the projecting lugs or shoulders, are machined. The circumferential corners of the stator laminations fit into these machined shoulders. Each frame ring is made in one piece, with the lugs and feet cast integrally.

The motor has a single-joint rotor with a one-piece winding, which affords mechanical ruggedness and is electrically indestructible. The rotor core itself is largely conventional, except that it has open slots without the usual overhanging tooth tips.

The entire winding of the rotor consists of an integral sheet of copper, punched and formed by a special process. This one-piece winding is machine-wrapped around the rotor core, the copper bars being expanded into the core slots by swaging. As it is fabricated of comparatively thin stock, having a high thermal conductivity, the rotor winding tends to radiate heat rapidly and can be easily maintained at a low temperature; the copper bars themselves, acting as fan blades, contribute to the cooling effect of the ventilating system. The new motor is made by the Louis Allis Co., Milwaukee, Wis.



The single-joint rotor and the one-piece winding



Heavy-duty motor of polyphase squirrel-cage type

An Automatic Plumb Bob

A plumb bob is now being made that is so constructed that adjustment of its height is accomplished quickly. This is effected by a slight turn of the milled cap shown, thus holding tight or releasing a spring reel inside the bob which automatically adjusts the length of string. The annoyance of broken, tangled or knotted cords is obviated through the use of the braided linen cord. A hole in the hard steel point permits its easy removal for protection from injury. This bob is manufactured by A. S. Aloe Co., 513 Olive St., St. Louis, Mo.

An easily adjusted plumb bob

The ring in which the finger is placed may be used for holding the bob or hanging it on a tripod. The milled thumb screw releases or tightens the linen cord so as to allow the automatic manipulation of the plumb bob.

New Oil-Fired Electric Drive Locomotive Designed

A new type of electric locomotive, using oil for fuel, said to be the first of its kind ever manufactured in America, has been built jointly by the General Electric Co. and the Ingersoll-Rand Co. This locomotive has been especially designed for switching service and will be given its first practical test by the New York Central.

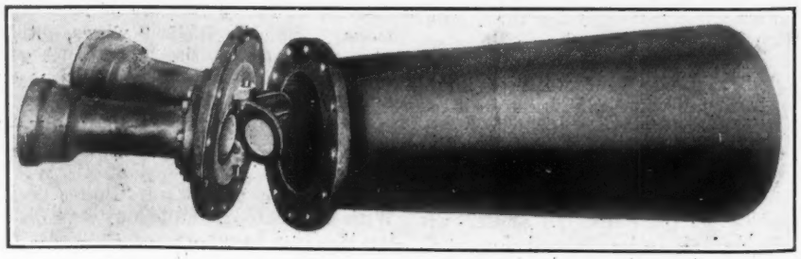
The power plant equipment consists of a 300-hp. oil engine manufactured by the Ingersoll-Rand Co., directly connected to a 200-kw. General Electric generator. The motive power consists of four HM-840 motors, one of which is geared to each of the four axles. The unit has a total weight of sixty tons on the drivers.

The General Electric Co. has put about ninety self-propelled motor cars and locomotives using gasoline as fuel into service during the last fifteen years, most of them still operating. The new unit is made up of well-tried apparatus as a result of this long experience. The locomotive has been in use in the yards of the Ingersoll-Rand factory at Phillipsburg, N. J.

Valve for Safety in Boiler Operation

Where two or more boilers are connected to a common blowoff line and the line is extensively used there is likely to be carelessness on the part of employees which may result in severe scalding of a man working in an empty boiler. As the blowoff usually takes considerable time, there is a tendency on the part of the employees to open a valve and then leave it with the intention of returning to close it. If the valve is inadvertently left open there is danger to a worker in the boiler if the blowoff from another boiler should be opened in the meantime.

A double-seated flap valve has been perfected to do away with this danger. A vertical pin hinges the V-shaped flap valve between the two 4-in. pipes which receive the blowdown from adjacent boilers. The entrance to the other boiler of the pair is blocked because of the seating of the valve and the outcoming steam and back pressure present holds it fast in place. When one wing is open to allow the blowdown to pass, the other wing automatically closes the entrance to the other boiler. The device has been perfected by J. W. Pearl, 30 North La Salle St., Chicago, Ill.



A valve intended to make boiler cleaning safe

The Market Report

Daily Prices of Metals

May	Copper, N. Y. net refinery*	Tin		Lead		Zinc
	Electrolytic	99 Per Cent	Straits	N. Y.	St. L.	St. L.
1	13.00@13.125	47.50	48.00	7.90	7.50	5.825
2	13.00@13.125	48.125	48.625	7.85	7.50	5.80
3	13.00@13.125	48.00	48.50	7.80	7.45	5.85
5	13.00@13.125	47.625	48.125	7.75	7.425	5.85
6	13.00@13.125	47.00	47.50	7.65	7.30	5.80
7	13.00@13.125	46.50	47.00	7.45	7.125	5.75
Av.	13.063	47.458	47.958	7.733	7.383	5.813

*These prices correspond to the following quotations for copper delivered: May 1st to 7th, inclusive, 13.25@13.375c.

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for deliveries constituting the major markets, reduced to the basis of New York cash, except where St. Louis is the normal basing point, or as otherwise noted. All prices are in cents per pound. Copper is commonly sold "delivered," which means that the seller pays the freight from the refinery to the buyer's destination.

Quotations for copper are for ordinary forms of wire bars, ingot bars and cakes. For ingots an extra of 0.05c. per lb. is charged and there are other extras for other shapes. Cathodes are sold at a discount of 0.125c. per lb.

Quotations for zinc are for ordinary Prime Western brands. Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

The quotations are arrived at by a committee consisting of the market editors of *Engineering and Mining Journal-Press* and a special representative of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce.

London

May	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic						
	Spot	3M		Spot	3M	Spot	3M	Spot	3M
1	63⅛	64	68¾	237	237	31	29⅞	30½	30¾
2	63⅜	64¼	68⅞	239	238⅝	30⅜	29	30½	30¾
5	63¼	64⅛	69	235½	235¼	29⅞	28⅜	30⅜	30⅝
6	63⅜	64¼	69	233½	233¼	28¾	27⅝	30⅛	30⅜
7	63⅛	64	69	227½	227½	28⅛	27	29⅞	30¼

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

May	Sterling Exchange "Checks"	Silver		Gold London	May	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
1	4.38⅛	64⅛	32 15/16	94s 2d	5	4.38⅛	64¼	33	94s 1d
2	4.38½	64⅜	33	94s 0d	6	4.38¼	64¼	33	94s 1d
3	4.38⅜	64	32 13/16	.....	7	4.38¼	64½	33⅛	94s 1d

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command one-quarter of a cent premium.

Metal Markets

New York, May 7, 1924

With the exception of copper, the tendency of the major non-ferrous metals has been distinctly downward. The unsettlement in lead and zinc, which were the weakest, is attributed to the decline in the London market prices. It is interesting to note, however, that the drop in European metal prices is held to be caused by weaker markets in the United States. Probably both markets are equally responsible for the price movement of the week. There is no doubt that the distress selling of speculative lots of all the non-ferrous metals abroad has been a very disturbing feature of the metal market during the last few weeks. The disposal of these lots can be linked with the franc speculation of numerous European metal houses and others. It is generally believed that liquidation of this class of metal has almost run its course in Europe.

Copper

The volume of copper sold during the week has been fair. Prices realized ranged between 13¼c. and 13⅜c., delivered, with some consignments bringing as high as 13½c. Reports from consumers indicate that their activity maintains a good pace and that if any general business slackening has occurred, the manufacturers of copper products remain immune from it. Judging from the frequent requests to make quick delivery, stocks in the hands of some consumers must be low. A slightly better tone to the copper market is noticeable and may have been brought about by the sale of a few round lots to prominent consumers. April is thought to have been another good month so far as the volume of metal going into consumption is concerned. Competition for business is still keen, with a few producers ready sellers today at 13¼c. but with most of them at 13⅜c. Foreign demand for copper has been poor, with Europe acting more as a seller than a buyer of the metal. The result of the German elections is held by some producers to augur well for the establishment of the reparations machinery provided by the Dawes Committee and a return to better industrial conditions in the Central Powers.

Correction: The price of London electrolytic copper on April 28 should have been quoted at 69¼c., instead of 69½c. Also, the April average should have been 70.150 instead of 70.163.

Lead

On Monday, May 5, the American Smelting & Refining Co. reduced its official contract price to 7.75c. and on May 7 a further reduction to 7.50c. per lb. was made, bringing the price of lead to the lowest level since Jan. 1 of this year.

The reductions are in accord with the market conditions. London prices have declined almost daily, so that unless corresponding reductions are made here, Mexican lead would gravitate to this market. In addition pressure to sell in St. Louis has been stronger than for several weeks, which has caused the price to sag in the West to 7.10 and 7.15c. per lb., at which levels moderate tonnages were sold today. Lead could be obtained in New York all the week below the official contract price without difficulty. Owing to the declining tendency of the market, many consumers have held off, hoping to procure lower prices later—an understandable aim—but the fact remains that producers generally are in a splendid position and that it would not take much of a buying wave to start prices upward again. One of the largest producers is already completely sold out for May. Many inquiries have been placed with producers merely to try out or feel the market. Some lead had been sold as far ahead as July, for which a price of 7.20c. per lb. was received, but by far the largest amount sold was for shipment during the current month. Corroding lead is selling for 10 points above the price of common grades.

Zinc

The zinc market is weak. Sales have been made to galvanizers at prices

ranging from 5.75 to 5.85c. per lb. for Prime Western brands. Production of zinc has been so heavy that a surplus for export now exists, but as the market abroad is weak, with prices unfavorable for making sales, no export business has been recorded. Zinc is comparatively cheap, but consumers do not seem overly anxious to lay in a stock even at these attractive prices. Prime Western for forward delivery commands a slight premium over spot —5 points for delivery as far ahead as July. Today the market is soft, with the metal obtainable at 5.75c. per lb. At least one producer is out of the market for the time being, owing to the low prices prevailing. The price of high-grade metal remains the same, 8 to 8¾c., depending upon delivery point. New York quotations for Prime Western are 35 points above St. Louis.

Tin

The shortage of spot supplies continues. It is likely that the premium for spot metal will last well into June, as the shipments afloat are concentrated in a few strong hands and are not apt to reach here in time to ease the pressure for prompt tin.

Arrivals of tin, in long tons, for April and for the first four months of the year, as compiled by the New York Metal Exchange, were as follows:

	1924 April	1924 4 months
Straits	8,450	23,620
Australian	15	240
Banka and Billiton	380	805
English	525	2,260
Chinese	480	1,155
Sundries	260	480
Total long tons	10,110	28,560

Foreign Exchange

Closing cable quotations on Tuesday, May 6, were as follows: francs, 6.625c.; lire, 4.51c.; and Canadian dollars, 1½ per cent discount.

Silver

The inquiry for silver recently has been from London rather than on direct orders from either India or China, and the demand seems to absorb available supplies, so that the market looks fairly steady at current figures.

Mexican Dollars—May 1st, 48⅞; 2d, 49; 3d, 48⅞; 5th and 6th, 49; 7th, 49¼.

Other Metals

Quotations cover large wholesale lots unless otherwise specified.

Aluminum—99 per cent grade, 28@29c. per lb.; 98 per cent, 27@28c. London, £115 per long ton.

Antimony—Per lb.:
Chinese and Japanese brands, 8¾@9c.
W. C. C. brand, 11½@12c.
Cookson's "C" grade, 12½@13c.
Chinese needle, lump, nominal, 8½@9c.
Prices easier owing to lighter demand. Market liable to turn with little more buying from consumers.

Bismuth—$2.40@$2.45 per lb. London, 10s.

Cadmium—60c. per lb. London, 2s. 3d.

Cobalt—$2.50@$3 per lb. for spot.

Iridium—$275@$300 per oz.

Nickel—27c. per lb. for 99 per cent virgin metal. London, £130 long ton.

Osmiridium—Crude, $58.50 per oz.

Palladium—$83 per oz. Crude, $60 per oz.

Platinum:
Refined, $115 per oz.
Crude, $110@$111 per oz.
Market slightly better but quiet. Supply short.

Quicksilver—$78 per 75-lb. flask. San Francisco wires $72.65; London, £14.

The prices of **Magnesium, Molybdenum, Monel Metal, Osmium, Radium, Rhodium, Selenium, Tellurium, Thallium,** and **Tungsten** are unchanged from prices given in May 3 issue.

Metallic Ores

Chrome—$19@$22, depending upon grade and source. Nominal.

Manganese—44@46c. per long ton unit, seaport, c.i.f. Nominal.

Molybdenum—80c. per lb. of MoS_2 for 85 per cent concentrates. Nominal.

Tungsten Ore—Per unit, N. Y.
High-grade wolframite, $9@$9.25.
High-grade scheelite, $9.25.
Ordinary grades, $8.60@$8.75.

Iron Ore, Magnetite, Tantalum, and **Vanadium** are unchanged from May 3 quotations.

Zinc and Lead Ore Markets

Joplin, Mo., May 3—Zinc blende, per ton, high, $41.10; basis 60 per cent zinc, premium, $39; Prime Western, $38@$39, closing; fines and slimes, $37@$35.50; average settling price, all zinc ore, $38.79.

Lead, high, $113.60; basis offering, $90; average settling price, all lead ore, $103.21 per ton.

Shipments for the week: Blende, 11,829; lead, 1,722 tons. Value, all ores the week, $636,640.

Buyers were offering but $38 basis up to 4 o'clock this afternoon, when someone increased the figure to $39, after which it is reported a scramble was made by a number of buyers to obtain a considerable tonnage on the latter basis, bringing these grades to a level with transactions for premium ore.

Reports in Eastern papers of a proposed "shutdown" of the mines cannot be verified, producers disclaiming knowledge of such an intent.

Platteville, Wis., May 3.—Blende, basis 60 per cent zinc, $42 to $43 per ton. Lead, basis 80 per cent lead, $90 per ton. Shipments for the week: Blende, 592 tons; lead, 20 tons. Shipments for the year: Blende, 8,394; lead, 292 tons. Shipments for the week to separating plants, 1,289 tons blende.

Non-Metallic Minerals

Asbestos:
Crude No. 1—$300@$400.
Crude No. 2—$175@$225.
Spinning fibers—$90@$150.
Magnesia and compressed sheet fibers —$60@$90.
Shingle stock—$50@$70.
Paper stock—$35@$40.
Cement stock—$20@$25.
Floats—$10@$12.
All per short ton, f.o.b. mines, Quebec, tax and bags included.

Diatomaceous Earth—Per ton, f.o.b. plant, California:
Powder, insulation, $30.
Aggregate, natural, $20.
Aggregate, calcined, $50.
Brick, kiln fired, $60.
Filtration powder, $30.

Barytes, Bauxite, Beryl, Borax, Chalk, China Clay, Emery, Feldspar, Fluorspar, Fuller's Earth, Garnet, Gilsonite, Graphite, Gypsum, Ilmenite, Limestone, Magnesite, Manjak, Mica, Monazite, Ocher, Phosphate, Pumice, Pyrites, Rutile, Silica, Sulphur, Talc, Tripoli and **Zircon** are unchanged from May 3 prices.

Mineral Products

Arsenious Oxide (white arsenic)—10c. per lb., nominal. Market quiet.

Copper Sulphate—4.90@5c. per lb. Demand recently improved.

Potassium Sulphate, Sodium Sulphate, Sodium Nitrate and **Zinc Oxide** are unchanged from the May 3 prices.

Ferro-Alloys

Ferrochrome, Ferromanganese, Ferromolybdenum, Ferrosilicon, Ferrotitanium, Ferrotungsten, Ferro-uranium and **Ferrovanadium** are unchanged from the prices given in the May 3 issue.

Metal Products

Copper—Sheets, 20¾c. base; wire, 15⅝c.

Lead Sheets—Cut, 12c.; full, 11¾c. per lb.

Nickel Silver—18 per cent Grade A sheets, 26¾c.

Yellow Metal—Dimension sheets, 18¼c.; rods, 15¼c.

Zinc Sheets—Base price, $9.75 per 100 lb., f.o.b. plant.

Refractories

Bauxite Brick, Chrome Brick, Firebrick, Magnesite Brick, Magnesite Cement, Silica Brick and **Zirkite** are unchanged from the May 3 prices.

The Iron Trade

Pittsburgh, May 6, 1924

The most substantial business being filled now is in rails, freight-car material, and structural material. In these three lines there is much forward business and production and deliveries are not affected by the general quietness. There is also fair buying of oil country goods.

Steel ingot production is down somewhat more than 20 per cent from the peak rate, in the fore part of March, which was a trifle over 50,000,000 tons per annum, a record high rate. There was overproduction, but only for a very short time, and a short period of underproduction will follow with possibly a substantial upturn in mill operations after July.

Finished steel prices steady. Automobile sheets from 5.35c. to 5.10c. Bars, shapes, and plates steady at 2.20@2.30c., Pittsburgh, and 2.30@3.45c., Chicago.

Pig Iron—Market stagnant; $22.50 for bessemer, $21 for basic, and $21.50 for foundry, f.o.b. Valley furnaces, with $1.76 freight to Pittsburgh.

Connellsville Coke—Market stagnant and production is decreasing. Spot quotable at $3.60@$4 for furnace coke and $4.75@$5.25 for foundry.

Company Reports

Miami Copper Co.

A report of the Miami Copper Co. for 1923 shows a balance before depletion of $2,301,386. Dividends paid amounted to $1,494,228. During the year 1923 there were mined 2,378,655 tons of ore. The production of refined copper amounted to 64,611,145 lb. The cost of operations at the property was 8.5c. per ton greater than in 1922, which was due largely to an advance in wages. This, with a lower yield, resulted in an increase of 1.2c per lb. in the cost of refined copper. However, as the price obtained for copper in 1923 was higher than that received in 1922, the net profit shows an increase.

On Jan. 1, 1924, ore reserves were as follows: High-grade sulphide ore, 5,106,643 tons running 2.08 per cent copper, mixed sulphide and oxide ore, 6,000,000 tons 2 per cent copper, low-grade sulphide ore, 36,000,000 tons 1.06 per cent copper.

Work upon new ore has been slow on account of its distance from the other workings. It is still being prosecuted as rapidly as possible, and while ore of good grade has been encountered in several drill holes the main objective has not yet been reached.

Operating Account

	Per Lb.	
Mine development, 2,378,655 tons	$0.0114	$737,383.05
Mining expense, 2,378,655 tons	.0339	2,190,060.56
Milling expense, 64,611,145 lb.	.0229	1,477,212.30
General expense at mine	.0107	688,573.23
Freight on concentrates	.0066	426,881.48
Smelting, refining and freight on pig copper	.0175	1,127,774.52
Legal	.001	67,458.18
New York office expenses and taxes	.0025	163,698.45
Selling expenses, freight discount, and commissions	.003	198,631.39
	$0.1095	$7,077,673.16
Less rentals and sales of power	.0002	12,523.74
	$0.1093	$7,065,149.42
Balance carried down		2,603,872.53
		$9,669,021.95

	Lb.			
Deliveries of copper,	65,891,306 @	$0.1464		$9,643,735.58
Less on hand Jan. 1, 1923,	22,417,073 @	0.1041		2,333,707.29
	43,474,233 lb.			$7,310,028.29
Plus on hand Dec. 31, 1923:				
Refined copper sold	2,252,919 @	$0.1305	$294,051.69	
In process	18,883,993 @	.1093	2,064,941.97	2,358,993.66
	64,611,145			$9,669,021.95

Profit-and-Loss Account

Depreciation charged off during year	$405,300.35
Difference in value of securities	100,986.72
Balance carried to balance sheet	2,301,386.27
	$2,807,673.34
Balance brought down	$2,603,872.53
Interest	148,566.81
Dividends received	55,234.00
	$2,807,673.34

Balance Sheet, Dec. 31, 1923

Assets

Property		$26,540,069.58
Development		1,200,922.29
Construction and equipment		3,190,756.85
Ore and metals on hand		2,377,118.66
Sundry materials and supplies		906,113.66
Prepaid taxes and insurance		18,540.30
Cash		278,754.08
Accounts receivable		314,192.75
Sundry investments and securities		4,297,030.10
		$39,123,498.27

Liabilities

Capital stock issued, 747,114 shares @ $5		$3,735,570.00
Accounts payable		1,387,970.58
Depletion balance, Jan. 1, 1923	$16,367,881.79	
Depletion for 1923	2,124,166.58	18,492,048.37
Surplus, balance, Jan. 1, 1923	$17,270,593.89	
Profit-and-loss account	2,301,386.27	
Less dividends 1,494,228.00	807,158.27	
	$18,077,752.16	
Less transferred to depletion reserve	2,124,166.58	
	$15,953,585.58	
Less adjustment relating to previous periods	445,676.26	15,507,909.32
		$39,123,498.27

Alaska Juneau Gold Mining Co.

A report of the operations of the Alaska Juneau Gold Mining Co. for 1923 shows a net loss after depreciation of $197,908.47.

Balance Sheet Dec. 31, 1923

Assets

Property		$9,641,670.22
Mine development		2,104,883.38
Construction and equipment—main plant		3,384,269.64
Portable and underground equipment		53,412.84
Deferred charges to future operations		522,685.86
Supplies		325,748.11
Production in transit		42,889.65
Cash accounts		17,681.69
Sundry accounts receivable		2,460.45
Deficit in surplus account		1,074,803.20
		$17,170,505.04

Liabilities

Capital stock—1,500,000 shares, $10 par	$15,000,000.00	
Less unissued—100,000 shares	1,000,000.00	
		$14,000,000.00
Notes payable—6 per cent guaranteed note		221,000.00
Bond issue—7 per cent 10-year gold bonds		1,894,000.00
Bond coupons due and not presented for payment		276,355.00
Bond interest—accruals after Sept. 15, 1923		39,191.91
Loan accounts and advances against current production		301,489.06
Payroll and accounts payable and other liabilities		75,681.09
Depreciation reserve		362,787.98
		$17,170,505.04

Profit-and-Loss Analysis

Dr.			
Mining		$568,682.15	
Milling		659,275.09	
Marketing concentrates and bullion		49,782.31	
Juneau, San Francisco, and New York expense and taxes		70,193.83	
Loss on sales scrap iron		6,583.41	
Bond issue expense		242.76	
Bond interest		149,592.42	
Interest on note and loan accounts		43,764.68	
			$1,548,116.65
Cr.			
Bullion production (from amalgamation)		$1,173,078.55	
Gold recovery	$1,165,564.41		
Silver recovery	7,514.14		
Concentrates production		341,695.59	
Gold recovery	$261,634.37		
Silver recovery	24,565.44		
Lead recovery	55,495.78		
Liability insurance, miscellaneous		3,259.71	
			1,518,033.85
Net loss for year before main plant depreciation			$30,082.80
Add main plant depreciation			167,825.67
Net loss for year after depreciation			$197,908.47

Production amounted to $1,427,198.78 in gold, 41,875 oz. of silver, and 55,496 lb. of lead. A total of 1,134,759 tons ore was milled from 2,476,240 tons mined, the remainder being rejected. Cost of mining per ton trammed was 22.97c.; milled, 26.6c.; total of all expenditures, 67.16c.

Progress in mill construction and rehabilitation work will continue until the new mill has a capacity of 10,000 tons per day, with an operating cost of 20c. per ton and with an improved metallurgical efficiency.

Coniagas Mines, Ltd.

Silver; Cobalt, Ont.

A report of the operations of the Coniagas Mines, Ltd., for the fourteen months ended Dec. 31, 1923, shows a revenue from the sale of metals of $858,334.25 and a net profit of $414,458.98. Dividends totaling $300,000 were paid. Balance sheet as of Dec. 31, 1923, follows:

Assets

Capital assets	$4,440,751.90
Investments	1,681,662.27
Current assets	462,736.88
Deferred charges to operations	77,649.98
	6,662,801.03

Liabilities

Capital—Authorized and issued 800,000 shares of $5 each, fully paid	$4,000,000.00
Current liabilities	274,894.53
Reserve for contingencies	168,431.76
Reserve for depreciation	340,616.94
Loss-and-gain account	
Surplus	1,878,857.81
	$6,662,801.03

Production amounted to 1,273,168 oz. of silver from 166,487 tons of ore.

Tonopah Belmont Development Co.

The results of the operation of the Tonopah Belmont Development Co. for 1923, with comparative figures for 1922 and 1921, were as follows:

	1923	1922	1921
Gross value of production	$842,963.75	$1,390,902.88	$1,793,660.17
Losses in treatment	31,328.36	75,346.01	147,701.62
Net values realized	$811,635.39	$1,315,556.87	$1,645,958.55
Operating expenses	630,764.06	984,931.44	1,153,964.49
Net earnings, mine and Tonopah mill	180,871.33	$330,625.43	$491,994.06
Net earnings of other plants	74,118.00	125,006.62	23,856.99
Total net earnings from operation	$254,989.33	$455,632.05	$515,851.05
Other income	( ) 62,187.21	(*a*) 64,422.11	(*a*) 56,149.58
Gross income	$317,176.54	$520,054.16	$572,000.63
Administration, exploration, taxes (*b*)	152,119.27	61,976.43	183,220.23
Net profit	$165,057.27	$458,077.73	$388,780.40

(*a*) Includes dividends from Belmont Surf Inlet Mines, Ltd.
(*b*) Includes $97,371.57 depreciation, shown on income account.

With no assured custom ore in sight, it was uneconomical to operate the Belmont mill (which has a daily capacity of 500 tons) upon such a small tonnage, and the mill was closed down on Aug. 1. The Belmont mine ore since then has been shipped to the mill of the Tonopah Mining Co. at Millers.

The management has made and will continue to make every effort to meet adverse conditions by curtailment of expenses wherever possible.

The option upon the Eagle-Shawmut mine, in California, has been given up.

At the Belmont Wagner property, in Colorado, productive operations were discontinued on Sept. 26.

The lease on the Belmont Extension Mining Co.'s property at Tonopah was forfeited.

Development work on the Tungsten & Gold Telluride Mining Co.'s property near Mina, Nev., proved that the ore did not go to depth, and the option was not exercised.

Balance Sheet—Dec. 31, 1923

Assets

Property			$1,717,932.16
Investments			
Belmont Surf Inlet Mines, Ltd.	$1,292,352.94		
Belmont Shawmut Mining Co.	976,315.22		
Belmont Wagner Mining Co.	950,503.16		
Esmeralda Power Co.	2,500.00		
Tonopah Divide Mercantile Co.	10,650.00		
Tonopah Mines Hospital Association	575.00		3,232,896.32
Loan to Jim Butler Tonopah Mining Co.			131,932.90
Available assets	576,593.75		
			$5,659,355.13

Liabilities

Capital stock, 1,500,000 shares of $1 each, fully paid			$1,500,000.00
Current liabilities		$41,757.48	
Surplus arising from the revaluation of mining property		$2,989,040.84	
Surplus account			
Balance Dec. 31, 1922	$1,098,660.85		
Adjustment of prior years	14,838.69		
Net income for 1923	165,057.27		
	$1,278,556.81		
Less dividends	150,000.00	1,128,556.81	4,117,597.65
			$5,659,355.13

Production amounted to 13,345.1 oz. of gold and 1,246,408 oz. of silver from 33,846 dry tons of ore.

Tennessee Copper & Chemical Corporation

The Tennessee Copper & Chemical Corporation in its 1923 report states that the combined net operating profit was $1,129,239.68 for that year, compared with $707,047.13 for 1922. Though the fertilizer market did not improve during the year, as anticipated, there was a larger demand for sulphuric acid than in the preceding year and the production of 60 deg. acid for 1923 amounted to 299,231 tons, compared with a production of 218,675 tons in 1922. This required the smelting of a larger tonnage of ore, which, together with the additional copper derived from the flotation plant, resulted in a production of 12,013,988 lb. of copper in 1923, compared with 7,553,281 lb. in 1922. The production of silver was 54,564 oz. and of gold 293 oz.

The operations of the flotation plant, the large converter, and the concentrator for the production of 66 deg. sulphuric acid, recently installed, have been efficient.

During 1923 three quarterly dividends, each of 25c. were paid, and a fourth of like amount, was paid Jan. 15, 1924.

Natomas Company of California

The annual report of Natomas Company of California for 1923 states that eight gold dredges were in operation and 15,423,378 cu.yd. (not including 2,522,166 cu.yd. dredged from lands not owned by the company) were dredged, yielding $1,416,801.54. Including the gold recovered from other lands, the total gold output was $1,576,591.27. Operating costs, including taxes, insurance, and rentals, were $1,101,929.17; net operating profit was $476,662.10. One less dredge was in operation than in 1922. All of the dredges in the Natoma field showed a good profit. The gross returns averaged 9.86c. per cu.yd.

Dredge No. 10 will exhaust its ground near Folsom about June 1, and will be dismantled and rebuilt on other ground owned by the company. The two dredges in the Feather River field operated during the greater part of the year on land owned by the American Gold Dredging Co. under a profit-sharing agreement that yielded the company a profit of $31,125.18. All of the land owned by the company upon which Feather River dredge No. 1 has been working is exhausted but the improvement of the Feather River channel through lands of the American Gold Dredging Co. will keep this dredge in operation during the greater part of 1924. Feather River dredge No. 3 is now working on lands owned by the company.

Granby Consolidated M., S. & P. Co.

A report of the operations of the Granby Consolidated Mining, Smelting & Power Co. for 1923 shows a net profit of $777,326.45 before depletion and depreciation. The construction program of the company is substantially finished.

The company has acquired, through exchange of Granby stock, 99.75 per cent of the outstanding stock of the Allenby Copper, Ltd., and the management of the property was assumed May 17, 1923.

Production and Sales

	1923	1922
Copper produced, lb.	32,562,459	31,963,565
Silver produced, oz.	442,604	442,505
Gold produced, oz.	8,139	6,996
Copper sold, lb.	40,004,843	26,634,440
Average price obtained, cents per lb.	14.848	13.296
Average cost sold New York (*a*)	11.809	11.156

(*a*) Previous to bond interest, depreciation and depletion.

Statement of Operations for 1923

Gross revenue from operations		$7,691,855.89
Operating costs		6,185,447.91
Gross profit from operations		$1,506,407.98
Insurance, taxes, interest and administrative expense		510,619.20
		$995,788.78
Add dividends from investments		67,870.00
		$1,063,658.78
Deduct interest on bonds		286,332.33
Net profit		$777,326.45
Reserves provided by order of board		
Depreciation	$796,829.01	
Depletion	644,499.57	
Capital loss on account of forest fires	43,284.44	
		$1,494,613.02
Deficit for 1923		$717,286.57
Deficit at Dec. 31, 1922 (adjusted)		706,079.86
Deficit at Dec. 31, 1923		$1,423,366.43

Balance Sheet, Dec. 31, 1923

Assets

Current assets—total inventories	$2,620,785.22
Accounts receivable	171,935.22
Cash	265,883.33
Total current assets	$3,058,603.77
Mines and mineral and timber land	6,835,331.92
Real estate, buildings, plant and equipment	9,011,000.07
Shares of other companies	5,989,910.17
Deferred and prepaid charges	581,433.26
Discount on capital stock sold	14,054,454.85
Deficit	1,423,366.43
	$40,954,100.47

Liabilities

Current liabilities		$2,566,335.47
Bonded debt 1st mortgage 6's	1,429,000.00	
Five-year 8 per cent debentures	2,500,000.00	
		3,929,000.00
Capital stock		
Issued—344,587.65 shares, at 100.00 (500,000 authorized)		34,458,765.00
		$40,954,100.47

United Verde Extension Mining Co.

The United Verde Extension Mining Co. reports for the first quarter of 1923 that the smelting plant at Clemenceau is running satisfactorily. The new turbine is nearly completed, as is the schoolhouse. No other construction is in progress except two or three houses for company employees.

The mine is in good condition. The company's copper is fairly well sold ahead in accordance with the usual policy, but the price does not justify the same dividend rate as of last year. The financial statement follows:

Cash on hand April 1, 1924	$ 278,323.57
Liberty Bonds, par value $3,363,950.00—market value	3,335,668.83
U. S. Treasury Certificates	100,000.00

The board of directors, at a meeting on March 19, 1924, declared a dividend of 50c. per share, payable on May 1, 1924, to stockholders of record at the close of business April 3, 1924.

Production amounted to 10,721,872 lb. for the quarter under review.

Gold and Silver Imports and Exports from San Francisco in February, 1924

Imports

In Ore and Base Bullion

	Gold	Silver
From		
Canada	$59,365	$31,991
Nicaragua	71,509	24,853
Mexico	46,886	105,719
Bolivia	.....	25,197
Peru	148,680	239,041
China	118,980	58
Dutch East Indies	447,250	106,178
Philippine Islands	133,146	1,975
Australia	.....	.....
New Zealand	78,752	114
	$1,104,568	$535,126
Coin and other bullion	1,744,931	20,306
Total	$2,849,499	$555,432

Exports

Foreign		
China	.....	$757,499
Japan	.....	97,574
Total 1,341,812 oz.	.....	$855,073
Domestic		
China	.....	1,724,417
Hongkong	$4,500	32,000
Mexico	27,460	.....
Japan	.....	320,137
Total 3,261,239 oz. silver	$31,960	$2,076,554

The total exports of refined silver for February, 1924, were 4,643,051 oz. The San Francisco price of silver on the basis of declared value for the month was 63.14c. per ounce.

Gold and Silver Imports and Exports from San Francisco in March, 1924

Imports

In Ore and Base Bullion

	Gold	Silver
From		
Canada	$31,789	$14,831
Nicaragua	20,988	3,129
Mexico	113,222	210,058
China	4,965	2
Philippine Islands	178,589	2,525
New Zealand	59,024	73
	$408,577	$231,618
Coin and other bullion	86,001	11,455
Total	$494,578	$243,073

Exports

Foreign		
China	.....	$572,452
Hongkong	.....	194,809
Total 1,197,845 oz.	.....	$767,261
Domestic		
Mexico	$85,950	.....
Hongkong	20,400	10,354
China	.....	1,755,165
Total 2,769,253 oz. silver	$106,350	$1,765,519

The total exports of silver for March, 1924, were 3,967,098 oz. The San Francisco price of silver on the basis of declared value for the month was 63.84c. per ounce.

Facts for the Stockholder

XXXIV—Texas Gulf Sulphur Co.

THE TEXAS GULF SULPHUR CO. was incorporated in Texas, in December, 1909, as the Gulf Sulphur Co. In 1918 its name was changed to Texas Gulf Sulphur Co. It is actively engaged in the development and production of crude sulphur at Gulf, Matagorda County, Tex., and in selling its product in the United States and other countries. In 1922 it participated with the Union Sulphur Co. and the Freeport Texas Co. in the formation of the Sulphur Export Association, to handle the sales of the three companies in foreign markets.

The property includes 2,950 acres of land at Gulf, Tex., covering a sulphur deposit having an area of about 300 acres. It has also mineral rights and water rights on several hundred additional acres of land in the vicinity. The sulphur deposit is located on Matagorda Bay 5 miles east of Matagorda and 90 miles southwesterly from Galveston. The town of Gulf, which was built and is owned by the company, provides living quarters for about 1,000 persons. The company employs about 300 men. The sulphur deposit averages about 80 ft. in thickness, and runs from 10 to 70 per cent sulphur. It is estimated that the sulphur reserves represent a life of twenty-five to thirty years. The producing capacity is about 1,000,000 tons of sulphur per annum.

Equipment includes 10,000 hp. of oil-burning boilers, pumps, air compressors, machine and blacksmith shops, assay, engineering and company offices and warehouses, and about 3½ miles of company-owned railroad.

Capital stock consists of 635,000 shares, par value $10. There is no funded debt. The original capitalization at incorporation, December, 1909, was $250,000. In July, 1918, the capitalization was increased to $750,000; in November, 1918, to $3,000,000; in April, 1919, to $5,000,000; in November, 1919, to $7,600,000; and in August, 1920, authorized capital was reduced to $6,350,000. The original capitalization of $250,000 was issued for $464 cash and $249,536 in property. Subsequent issues of stock at par for cash were: $500,000 in July, 1918, $2,250,000 in November, 1918, and $2,000,000 in April, 1919. In November, 1919, $100,000 additional stock was issued for $100,000 of property at par, and $2,500,000 stock, 50 per cent paid, was issued for $1,250,000 cash. In 1920, $1,250,000 full-paid stock was issued in exchange for the $2,500,000 stock which had been issued 50 per cent paid.

Gross income during the past few years has been as follows: $8,153,000 in 1920; $5,882,000 in 1921; $9,075,000 in 1922; and $10,746,000 in 1923. The corresponding net income, after deducting total cost of sales and other expenses, including federal taxes, was: $3,327,000 in 1920; $1,949,000 in 1921; $3,853,000 in 1922; and $4,737,000 in 1923. The indicated earnings per share were: $1.52 in 1919 (production started in March, 1919); $5.24 in 1920; $3.07 in 1921; $6.07 in 1922; and $7.46 in 1923.

On Dec. 31, 1923, assets amounted to $10,117,407, of which working assets were $4,818,936 and current assets $5,298,471; with current liabilities at $225,887, leaving net working capital at $9,891,520, before federal taxes. Net tangible assets are estimated at about $21 a share. Lands and development are carried at cost, and the appreciated value of the sulphur that is still in the ground has not been capitalized.

Dividends have been paid as follows: In 1921, $0.50 regular and $0.50 extra; in 1922, $3.75 regular and $1.25 extra; in 1923, $5.75 regular and $0.50 extra. The present yearly dividend rate is $6, payable quarterly. On Feb. 21, 1924, the directors declared an extra dividend of 25c. a share in addition to the quarterly dividend of $1.50. In the first quarter of 1923, the $1.25 quarterly dividend was made 47.43 per cent from free surplus and the balance from reserve for depletion. In the second quarter 38.1 per cent of the $1.50 dividend was from surplus and the rest from depletion. In the third quarter 44.6 per cent of the $1.50 dividend was from surplus and the rest from depletion. In the fourth quarter 29.5 per cent of the $2 dividend was made from surplus accumulation of funds and the balance from depletion.

Price range of the stock has been as follows: High, 67 in 1922; low, 23¼ in 1921; closing price, 59¾ on May 6, 1924.

INVESTIGATOR.

Mining Stocks

Week Ended May 3, 1924

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Alaska-Br. Col.	N. Y. Curb	...	...	*15	...	...
Anaconda	New York	32¾	32	32¾	De.15, Ja.21, Q	0.75
Arcadian Consol.	Boston	1 1/16	1	1 1/16	...	...
Ariz. Com'l.	Boston	9	8½	8½	Ja.15, Ja.31	0.50
Calaveras	N. Y. Curb	...	...	1⅛	...	...
Calumet & Arizona	Boston	46½	44	46½	Mc.7, Mc.24, Q	0.50
Cal. & Hecla (New)	Boston	15⅞	14¼	14¼	De. 1, De. 17	0.50
Canario Copper	N. Y. Curb	2¼	2	2 1/16	...	...
Cerro de Pasco	New York	46¼	44½	45½	Ap. 17, My. 1	1.00
Chile Copper	New York	28	27⅛	27⅛	Jn.2, Jn.30, Q	0.62½
Chino	New York	16½	16¼	16¼	Sept., 1920,	0.37½
Con. Coppermines	N. Y. Curb	2¼	2 1/16	2 1/16	...	...
Copper Range	Boston	22	21¼	21¼	May, 1923	1.00
Crystal Copper	Boston Curb	74	65	65	...	...
Davis-Daly	Boston	*65	*65	*65	Mar., 1920	0.25
East Butte	Boston	4½	4½	4½	Dec., 1919	0.50
First National	Boston Curb	...	...	27	Feb., 1919,	0.15
Franklin	Boston	*75	*75	*75	...	...
Gadsden Copper	Boston Curb	*40	*40	*40	...	...
Granby Consol.	New York	15⅜	15⅛	15⅛	May, 1919	1.25
Greene-Cananea	New York	13	12½	13	Nov., 1920	0.50
Hancock	Boston	1	1	1	...	...
Howe Sound	N. Y. Curb	2⅜	2⅛	2⅛	Ap.1, Ap.15, Q	0.05
Inspiration Consol.	New York	25⅛	24⅛	24⅛	De.20, Ja.7, Q	0.50
Iron Cap	Boston Curb	3	2½	2½	May, 1923	0.15
Isle Royale	Boston	15	14¼	14¼	Se. 1, Se. 15,	0.50
Jerome Verde Dev.	N. Y. Curb	1	*99	1	...	...
Jib Consol.	N. Y. Curb	*20	*15	*15	...	...
Kennecott	New York	38⅞	37⅜	38⅛	Mc.7, Ap. 1, Q	0.75
Keweenaw	Boston	†*91	...	...	...	...
Lake Copper	Boston	†1½	...	...	...	...
Magma Copper	New York	19⅜	19	19⅜	Jan., 1919	0.50
Mason Valley	N. Y. Curb	1⅜	1⅛	1⅛	...	...
Maas Consolidated	Boston	†*60	...	...	Nov., 1917	1.00
Miami Copper	New York	22	20⅜	20⅜	My. 1, My. 15, Q	0.50
Mohawk	Boston	*29½	*28	*28	Se. 22, Oc. 13,	1.00
Mother Lode Coa.	New York	8⅛	7⅞	7⅛	De.14, De.31	0.50
Nevada Consol.	New York	13	12⅝	13	Sept., 1920,	0.25
New Cornelia	Boston	18⅛	18	18⅛	My.9, My.26,	0.25
New Dominion	N. Y. Curb	2⅜	2⅜	2⅜	...	...
North Butte	Boston	2¼	2⅛	2⅛	Oct., 1918,	0.25
Ohio Copper	N. Y. Curb	*75	*69	*74	...	...
Old Dominion	Boston	19⅜	19	19	Dec., 1918	1.00
Phelps Dodge	Open Mar.	†125	†115	...	Mc.24, Ap.2 Q	1.00
Quincy	Boston	17½	17½	17½	Mar., 1920	1.00
Ray Consolidated	New York	9⅞	9⅝	9⅝	Dec., 1920	0.25
Ray Hercules	N. Y. Curb	...	...	*13	...	...
St. Mary's Min. Ld.	Boston	29½	29⅛	29⅛	Ap.22, My.20	3.00
Seneca Copper	New York	1⅛	⅞	⅞	...	...
Shannon	Boston	*35	*35	*35	Nov., 1917	0.25
Shattuck Arizona	New York	6	5	5⅛	Jan., 1920	0.25
South Lake	Boston	...	...	*25	...	...
Superior & Boston	Boston	*70	*60	*69	...	...
Tenn. C. & C. cfs.	New York	7	6⅞	7	De.31, Ja.15, Q	0.25
Utah Copper	New York	67½	66⅛	66⅛	Mc.14, Mc.31, Q	1.00
Utah Metal & T.	Boston	*30	*30	*30	Dec., 1917	0.30
Victoria	Boston	*25	*25	*25	...	...
Walker Mining	N. Y. Curb	3⅛	3 1/16	3 1/16	...	...
Winona	Boston	†*15	...	...	...	...
NICKEL-COPPER						
Internat. Nickel	New York	12⅛	11⅞	11⅞	Mar., 1919	0.50
Internat. Nickel pfd.	New York	...	...	77⅛	Ap.17, My.1, Q	1.50
LEAD						
Carnegie Lead & Zinc	Pittsburgh	6	4	4	...	...
National Lead	New York	132½	127	131½	Mc.14, Mc.31, Q	2.00
National Lead pfd.	New York	112½	112½	112½	My. 23, Ju. 14, Q	1.75
St. Joseph Lead	New York	23⅛	23⅛	23⅛	Mc. 20, 1924	0.50
ZINC						
Am. Z. L. & S.	New York	8	7⅞	7⅞	May, 1920	1.00
Am. Z. L. & S. pfd.	New York	27	26½	27	Nov., 1920	1.50
Butte C. & Z.	New York	5⅛	4⅞	4⅞	Ma., 1923	0.50
Butte & Superior	New York	16⅜	15¼	16¼	Je.15, Je. 30, Q	0.50
Callahan Zn-Ld.	New York	4⅛	4	4	Dec., 1920	0.50
New Jersey Zn.	N. Y. Curb	135½	134½	135	May 10, 1924	2.00
United Zinc	N. Y. Curb	...	...	*25	...	...
Yellow Pine	Los Angeles	80	60	80	Mar., 1924	0.04
SILVER						
Alvarado	N. Y. Curb	...	...	1½	...	...
Beaver Consol.	Toronto	23	22	22½	May, 1920	0.03
Castle-Trethewey	Toronto	†*75½	†*74	*76	...	...
Coniagas	Toronto	2.00	1.90	1.90	Ap.20, My.1	0.02½
Crown Reserve	Toronto	*62	*54	*61	Jan., 1917	0.05
Keeley	Toronto	2.24	2.17	2.24	...	...
Kerr Lake	N. Y. Curb	...	...	1⅛	Ap.1, Ap.15, Q	0.12
La Rose	Toronto	*12½	*11⅛	*11⅛	Apr., 1922	0.10½
Lorrain Trout Lake	Toronto	1.37	1.30	1.36	...	...
McKinley-Dar.-Sav.	Toronto	*13	*12½	*13	Oct., 1920	0.03
Mining Corp. Can.	Toronto	3.40	3.00	3.25	Sept., 1919	0.12½
Nipissing	N. Y. Curb	6	5⅜	6	Mc.1, Ap.21, Q	0.03½
Ontario Silver	New York	...	...	6	Jan., 1919	0.50
Temiskaming	Toronto	*26	*26	*26	Jan., 1920	0.40
GOLD						
Alaska Gold	New York	⅛	⅛	⅛	...	...
Alaska Juneau	New York	1⅛	1⅛	1⅛	...	...
Argonaut	Toronto	*51	*49	*52	...	...
Carson Hill	Boston	†1⅛	...	...	...	...
Cresson Consol. G.	N. Y. Curb	3 1/16	3⅛	3⅛	Mc.3, Ap.10, Q	0.10
Dome Mines	New York	16¼	15	16¼	Mc.26, Ap.21, Q	0.50
Golden Cycle	Colo. Springs	1.31	1.25	1.25½	My.31, Jn.10 Q	0.03
Hollinger Consol.	Toronto	12.65	12.55	12.55	My. 1, My. 19	0.05
Homestake Mining	New York	50	49½	49½	Ap.19, Ap.25, MX	1.50
Kirkland Lake	Toronto	23	21	22	...	...
Lake Shore	Toronto	3.85	3.78	3.78	My.1, My.15	0.02
McIntyre-Porcupine	New York	15⅜	15⅛	15⅜	Ap. 1, My. 1,	0.25
Newray	Toronto	32	31	31	...	...
Portland	Colo. Springs	61	60	60	Oct., 1920	0.01
Teck-Hughes	Toronto	1.25	1.14	1.24	...	...
Tom Reed	Los Angeles	37	28	35	Dec., 1919	0.02
Tough-Oakes	Toronto	68	65	68	...	...
United Eastern	N. Y. Curb	*61	*57	*57	Ap 10, Ap.28, Q	0.10
Vipond Cons.	Toronto	1.15	1.04	1.15	...	...
Wright-Hargreaves	Toronto	3.00	2.95	2.95	Mc.15, Ap. 1, Q	0.02½
GOLD AND SILVER						
Black Oak	N. Y. Curb	*67	*62	*67	...	...
Con. Cortez	N. Y. Curb	3⅛	3⅛	3⅛	...	...
Con. Virginia	San Francisco	5⅛	4⅛	4⅛	...	...
Continental Mines	N. Y. Curb	...	...	2⅛	...	...
Dolores Esperanza	N. Y. Curb	*50	*50	*50	Jy. 1, Jy. 10 Q	0.05
Premier Gold	N. Y. Curb	2	1⅞	1⅞	Mc.28, Ap.5	0.08
Tonopah Belmont	N. Y. Curb	*52	*46	*52	Apr., 1923	0.05
Tonopah Divide	N. Y. Curb	*26	*25	*25	Se.22, Oc. 10	0.10
Tonopah Extension	N. Y. Curb	2 1/16	2 1/16	2 1/16	Mc. 11, Ap. 1	0.05
Tonopah Mining	N. Y. Curb	1⅛	1⅛	1⅛	Ap. 6, Ap. 21	0.07½
Unity Gold	N. Y. Curb	1⅛	1⅛	1⅛	...	...
West End Consol.	N. Y. Curb	*51	*48	*48	Mar., 1923	0.05
Yukon Gold	N. Y. Curb	*65	*65	*65	June, 1918	0.02
SILVER-LEAD						
Ahumada	Boston Curb	6	5⅛	5⅛	Mc., Ap. 2, X	0.15
Bingham Mines	Boston	†15	...	...	Sept., 1919	0.25
Cardiff M. & M.	Salt Lake	...	...	*84	Dec., 1920	0.15
Chief Consol.	Boston Curb	3⅛	3⅛	3⅛	Ap.19, My.1, Q	0.10
Columbus Rexall	Salt Lake	*23⅛	*22	*22⅛	Aug., 1922	0.03
Consol. M. & S.	Montreal	34½	34	34	Oct., 1920	0.62½
Daly Mining	Salt Lake	...	...	205	July, 1920	0.10
Erupcion	Boston Curb	...	...	2⅛	Mc. 15, Ap.2, X	0.15
Federal M. & S.	New York	...	...	8	Jan., 1909	1.50
Federal M. & S. pfd.	New York	44	43	43⅛	Fe.26, Mh.15, Q	1.75
Florence Silver	Spokane	*13	*10⅛	*12⅛	Apr., 1919, QX	0.01
Hecla Mining	New York	8⅞	8⅛	8⅛	My.15, Jn.15,	0.25
Iron Blossom Con.	N. Y. Curb	*28	*28	*28	Oct., 1923	0.02
Marsh Mines	N. Y. Curb	*8	*8	*8	June, 1921	0.02½
Park City	Salt Lake	...	...	4.75	Mar., 1924	0.15
Park Utah	N. Y. Curb	...	...	3½	Mc.15, Ap.1	0.15
Prince Consol.	Salt Lake	...	...	*75	Nov., 1917	0.02
Silver King	N. Y. Curb	...	...	2	Ap. 1, X	0.30
Silversmith	Spokane	46½	45	45	My. 1, My. 10	0.01
Tamarack-Custer	Spokane	1.89	1.85	1.88	Se.30, Oc. 1, K	0.02
Tintic Standard	Salt Lake	4.05	3.97½	4.00	Mar. 25, 24, QX	0.15
Utah-Apex	Boston	2⅛	2⅛	2⅛	June, 1923,	0.50
IRON						
Bethlehem Steel	New York	51½	47⅛	49½	Jn.1, Jy.1, Q	1.25
Char. Iron	Detroit	⅞	⅞	⅞	...	...
Char. Iron pfd.	Detroit	...	...	1 1/16	...	...
Colorado Fuel & Iron	New York	39¼	32¼	39½	My.10, My.26	Q 2.00
Col. Fuel & Iron pfd.	New York	...	...	102	Feb., 1923	2.00
Gt. North'n Iron Ore	New York	27½	27½	27⅛	De.10, De.27	2.00
Inland Steel	N. Y. Curb	...	...	46	My.15, Jn. 1	Q 0.62½
Mesabi Iron	N. Y. Curb	5	3	3	...	...
Replogle Steel	New York	8½	8	8½	...	...
Republic I. & S.	New York	47⅛	44	45	May, 1921	1.50
Republic I. & S. pfd.	New York	...	...	86	Mh.20, Ap.1	QX 2.75
Sloss-Sheffield S. & I.	New York	57	55½	55½	Feb., 1921	1.50
Sloss-Shef. S. & I. pfd.	New York	...	...	80	De.20, Ja.2, Q	1.75
U. S. Steel	New York	100½	97½	99	Jn.1, Jn.28	QX 1.75
U. S. Steel pfd.	New York	120½	119⅛	120½	My.6, My.29, Q	1.75
Virginia I. C. & C.	New York	41	40	41	De.15, Ja. 2	1.50
Virginia I.C. & C. pfd.	New York	...	...	74	De.15, Ja.22	2.50
VANADIUM						
Vanadium Corp.	New York	23¼	22	22⅜	Jan., 1921	1.00
ARSENIC						
Western Utah Copper	N. Y. Curb	*20	*20	*20	...	...
ASBESTOS						
Asbestos Corp.	Montreal	...	...	28	Se.29, Oc.15	Q 1.00
Asbestos Corp. pfd.	Montreal	...	...	55	Ap.1, Ap.15,	Q 1.50
SULPHUR						
Freeport Texas	New York	10	8⅛	9⅛	Nov., 1919,	1.00
Texas Gulf	New York	59⅛	58	59⅛	Mh.3, Mh.15	QX 1.75
PLATINUM						
So. Am. Gold & P.	N. Y. Curb	3⅛	3⅛	3⅛	...	...
MINING, SMELTING AND REFINING						
Amer. Metal	New York	42	41⅞	42	My.20, Jn.1, Q	0.75
Amer. Metal pfd.	New York	107½	107⅛	107⅛	My.20, Jn.1, Q	1.75
Amer. Sm. & Ref.	New York	63⅞	60⅛	63⅛	Ap. 11, My.1, Q	1.25
Amer. Sm. & Ref. pfd.	New York	100⅛	98⅛	100⅛	My. 9, Jn. 1.	1.75
U. S. Sm. R. & M.	New York	20⅛	20	20	Jan., 1921,	0.50
U. S. Sm. R. & M. pfd.	New York	40	38⅞	40	Apr., 1924, Q	0.87½

* Cents per share. † Bid or asked. Q, Quarterly. SA, Semi-annually. M, Monthly. K, Irregular. I, Initial, X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, Stock and Mining Exchange; Colorado Springs, Colorado Springs Stock Exchange.